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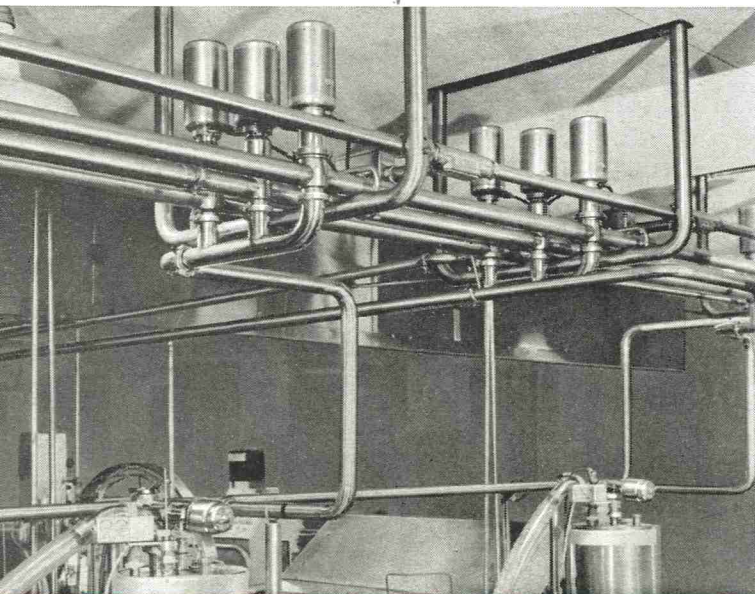
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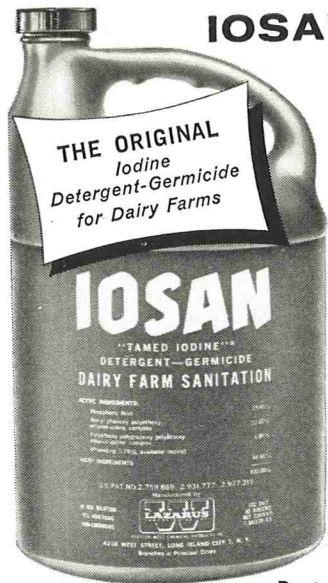
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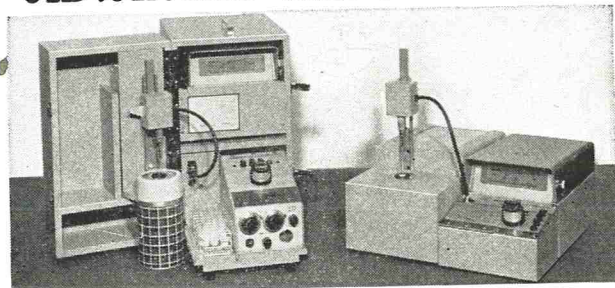
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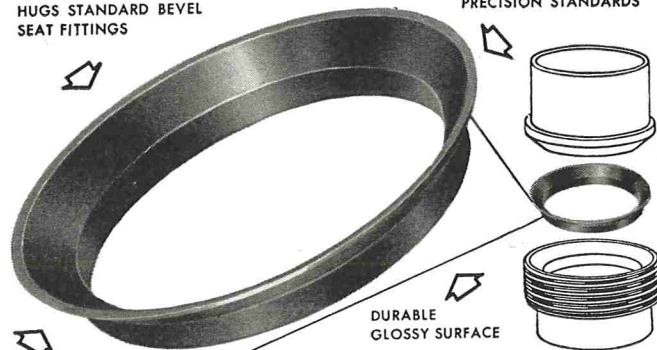
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## CHEMICAL SANITIZER CONFUSION

There is no doubt that the use of chemical sanitizers in the food industry needs regulation in the protection of public health. Unfortunately in conjunction with our efforts to protect public health, we have accumulated a considerable amount of confusion regarding the use of chemical sanitizers. This situation will become worse as the use of additional sanitizing agents are sanctioned unless something is done to remedy it in the near future.

### WHO IS RESPONSIBLE?

Before a remedy is suggested, we might do well to attempt to determine just who is responsible for the sanitizer confusion. No doubt the confusion is the result of contributions from many sources, some of which are discussed here. The order of presentation is not necessarily their order of importance.

Contradictions by regulatory agencies cause a great deal of confusion. The United States Public Health Service has adopted what appears to be a very sensible chemical sanitizer *performance* code. This code accepts any sanitizing product if it has been proven to be non-toxic to humans and if the desired job is accomplished. Such a *performance* code is easy to keep up to date as new research developments occur and it should not hinder progress in improving the quality of our food or sanitary standards in general. Unfortunately, some state and local public health agencies have not adopted the USPHS *performance* code. Instead some agencies are using old *specification* codes which were written before the introduction of many new chemical sanitizers and methods. It is still more unfortunate when an outdated *specification* code is being administered by an official in an arbitrary and restrictive manner, permitting virtually no new products or methods. Improper actions by just a few public health officials will contribute much to the sanitizer confusion.

Another contributor to the chemical sanitizer confusion is the sanitizer compounder and/or salesman when they are not well-grounded in the food industry sanitation field. In their eager attempts to launch a product these people often exaggerate the merits of and forget the limitations of their product. Although the majority in this group are inherently honest, they do inestimable damage to the sanitation industry by spreading misleading information.

Still other contributors, undoubtedly the most inexcusable ones, are those who deliberately start false rumors involving a competitor's product. A case comes to mind in which the quarternary ammonium sanitizers were said to cause serious cheese starter failures. Subsequent investigations by several state experiment stations revealed that the amount of quarternary which might get into the milk supply was not great enough to cause the starter failures. A more plausible explanation is antibiotics and/or phage contamination. False rumors of this sort certainly add to the sanitizer confusion.

Control laboratories, including private, city and state may contribute to the confusion, especially if the person in charge has vested interests in a particular product. This would also apply to research laboratories at educational institutions.

### WHAT IS THE REMEDY?

The food industry should no longer have to put up with unfair restrictive sanitation codes which hinder progress in improving the quality of our foods. A nation-wide uniform *performance* code governing the use of chemical sanitizers in the food industry would be most helpful in clarifying the existing confusion. A code which is perfectly acceptable in hundreds of towns, but not acceptable in a few localities, does not make good sense. A national referee board to guide the use of chemical sanitizers for the food industry should be helpful. Such a board would be composed of a group of experts delegated by the USPHS.

When so much authority is vested in one individual, such as state and local public health officials, it should be a paramount prerequisite for that individual to have the proper training. Even if the individual authority has honest intentions but inadequate knowledge, he cannot perform his duty wisely. Advocating local and state public health officials who have the proper training in their field should help clear up the chemical sanitizer befuddlement.

The confusion could be further lessened if those who do not have the knowledge pertaining to chemical sanitizers would stay out of that business.

The confusion could be lessened still further if those who are charged with the responsibility of safeguarding the public health would make sure that they are not influenced by vested interest groups.

W. S. MUELLER

University of Massachusetts

Institute of Agricultural and Industrial Microbiology  
Amherst, Massachusetts

## STAPHYLOCOCCI IN COTTAGE CHEESE<sup>1</sup>

ROSS MICKELSEN<sup>2</sup>, V. D. FOLTZ<sup>3</sup>, W. H. MARTIN<sup>2</sup>  
AND CHARLES A. HUNTER<sup>4</sup>

*Kansas Agricultural Experiment Station, Manhattan*

(Received for publication July 11, 1962)

Considerable attention has been directed to staphylococci in food. Cases of staphylococcal food poisoning associated with spray-dried milk (1, 2) and cheese (6, 8) have been reported in recent years. In a survey of a wide variety of cheese, excluding cottage, obtained at the consumer level, 70.4% contained *Staphylococcus aureus* (11). Walker, et al. (14) have reported results of a study involving the survival of staphylococci in Colby cheese. Jezeski, et al. (7) made Cheddar and Colby cheese with milk containing 25,000 to 100,000 *Staphylococcus aureus*, strain 196E per ml. Both showed maximum counts of *Staphylococcus aureus* within 24 hr after setting.

Mattick, et al. (10) in a study of multiplication of *Staphylococcus aureus* in 4 variations of Cheddar cheeses of slightly different pH, found that *Staphylococcus aureus* added to the milk increased almost 8-20 fold after stirring of curd. The number dropped during the 1st 7-10 weeks of storage and the organisms were completely eliminated in 14-22 weeks of storage. Roughley and McLeod (12) inoculated pasteurized milk with several strains of *Staphylococcus aureus* and manufactured it into Cheddar cheese. They found that the number of *Staphylococcus aureus* increased during the process up to hooping. During curing, counts generally showed a marked decline and no *Staphylococcus aureus* could be isolated from any samples after 10 days. Lyons and Mallmann (9) noticed that survival of *Staphylococcus aureus* in cottage cheese was linked with pH and the organisms could survive up to 192 hr at pH 4.6. Stadhouders (13) observed seasonal variation in starter activity which he associated with the seasonal variation of peroxidase activity of milk. He found that increased peroxidase activity of milk inhibited the cultures.

If pasteurized milk containing staphylococci or

low heat, skim milk powder containing staphylococci were subsequently made into cottage cheese, incubation temperature and time could be conducive to considerable growth with accompanying enterotoxin development during manufacture. The high acidity encountered during manufacture of cottage cheese may inhibit staphylococcal growth. However, Foltz, et al. (4) isolated staphylococci from cultured butter milk. The isolation of staphylococci from cultured butter milk points out that some strains of the organism apparently tolerate acidity levels equal to or greater than those encountered in the manufacture of cottage cheese.

Cottage cheese with its long setting period likely provides environmental conditions suitable for the growth of enterotoxigenic staphylococci. In attempting to determine the possible role that the organisms play in the manufacture of cottage cheese, answers were sought to the following questions:

1. What is the incidence of staphylococcal contamination in cottage cheese at the commercial level?
2. Is there a seasonal trend in the incidence of staphylococcal contamination in commercial cottage cheese?
3. Do staphylococci increase in number during the setting period for long-time and short-time methods of cottage cheese manufacture?
4. Do staphylococci survive the customary minimum cooking period (120F for 30 min) under the acidic condition prevailing during the manufacture of cottage cheese?
5. If staphylococci survive the cooking process, do they multiply in the curd during subsequent storage?

### MATERIALS AND METHODS

Samples of cottage cheese were obtained from retail outlets during winter and summer months. All samples were held in the original container under refrigeration at 35F from the time of collection until analysis was started. Total elapsed time of holding never exceed 24 hr.

#### *Bacteriological Examination*

Both Tellurite-Glycine agar (TG) as recommended by Zebovitz, et al. (16) and *Staphylococcus Medium* No. 110 (S-110) (17) were used for initial isolation of staphylococci. In addition, an enrichment

<sup>1</sup>Contribution No. 308, Department of Dairy Science, and contribution No. 390, Department of Bacteriology, Kansas Agricultural Experiment Station, Manhattan; supported in part by research grant E-3157 from the National Institutes of Health, and the Public Health Service.

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<sup>3</sup>Department of Bacteriology, Kansas State University.

<sup>4</sup>Kansas State Board of Health, Division of Public Health Laboratories. The authors thank Ranjit S. Kadan, graduate student, Department of Dairy Science, for his help in preparing this manuscript.



procedure was used in which 0.1 g of cheese (1.0 ml of a 1-10 water suspension) was transferred to 10.0 ml of enrichment broth consisting of Staphylococcus Medium No. 110 minus the gelatin and agar.

Packages were opened and 11 g of cheese were weighed into 99 g of sterile water in pint jars, Oster Blender heads were used to prepare a 1-10 suspension of each sample.

A 1.0-ml volume of each cheese-water sample (0.1 g cheese) was aseptically transferred to plates of TG and S-110 media. The surface plating technique of Snyder (18) was used to spread the sample over the plates. At the same time 1.0 ml of the cheese-water suspension was transferred to 10.0 ml of S-110 Enrichment Broth.

The TG and S-110 plates were incubated at 37C for 24 and 48 hr, respectively, at which time suspected colonies were isolated to proteose-peptone agar slants for identification.

The S-110 enrichment broth tubes were incubated at 37C for 24 hr after which time aliquots were transferred to and incubated on GT and S-110 plates as previously described. These plates were designated GTE and 110E. Suspected colonies were isolated for study and identification as were isolated from the GT and S-110 plates.

#### Proof of isolation

Isolates from the TG, S-110, TGE and S-110E plates were first purified by sub-reisolation on proteose-peptone agar plates by streak-plate isolation. Reisolation was made to proteose-peptone agar slants. Purified cultures were subjected to Gram's stain. Morphologically typical isolates were retained and subjected to the following examination:

1. *Anaerobic growth*: Melted and cooled tubes of glucose yeast extract agar were inoculated by needle-stab and immediately cooled. Growth in the bottom of the tube was necessary to retain the culture as a member of the genus *Staphylococcus*.

2. *Mannitol fermentation*: Sugar-free peptone agar base in deep tubes to which 1% mannitol was added was inoculated similarly to the method for determining anaerobic growth. Anaerobic fermentation of mannitol was considered a positive finding in describing an organism as *Staph. aureus*.

3. *Coagulase test*: Citrated plasma (Difco) was used to carry out the tube coagulase test using 0.5 ml plasma, 1 loop of culture from a 24-hr slant and a maximum incubation time of 4 hr at 37C.

4. *Frazier's gelatin Agar*, in plates, was used to determine gelatin hydrolysis. Hydrolysis was determined by flooding the plates with Frazier's developer after incubation.

5. *Action on blood*: Proteose-peptone agar base

to which 5% defibrinated sheep blood had been added was the medium employed. Incubation was for 48 hr at 37C. Hemolysis was described as typical of beta or a combination of beta and alpha.

6. *Pigmentation* was determined from growth on Frazier's gelatin agar before testing for gelatin hydrolysis.

7. *Bacteriophage typing*: All *Staph. aureus* cultures were sent to the Regional Typing Center, Public Health Laboratories, Kansas State Board of Health, Topeka for typing. This laboratory follows the recommendations for bacteriophage typing as established by the National Reference Laboratory, Laboratory Branch, Communicable Disease Center, U. S. Public Health Service, Chamblee, Georgia.

#### Source of known culture

A known culture (196E) of a potentially pathogenic *Staphylococcus aureus* was obtained from Dr. G. M. Dack of the Food Research Institute, University of Chicago. The cell suspension of the organisms was prepared by washing a 24-hr proteose-peptone agar plate with 15 ml of sterile saline solution, filtering and adjusting to 50% transmittance at 500 m $\mu$  as measured on a Bausch and Lomb Spectronic 20.

#### Inoculation of milk

Small batches of cottage cheese were made by both long and short-set procedures described by Hales (5). When starter was added, 0.5 ml of cell suspension was added to 5 quarts of skim milk to give a "light" staphylococcal contamination (approximately 10,000 per ml). Twenty-five ml of the cell suspension in 5 quarts of skim milk gave a "heavy" staphylococcal contamination (approximately 500,000 per ml). Samples of the milk or curd were collected at the beginning of setting, at the end of cooking, and at the end of the 3rd rinse and were plated on S-110 and TG agar as described.

The washed curd was divided into three portions; one portion was frozen, a second maintained at 40-50F, and the 3rd held at 70F. The curd was surface plated on S-110 and TG agar at 48-hr intervals for six days.

#### RESULTS AND DISCUSSION

The results of the analyses of 24 samples of commercial cottage cheese obtained during winter months and 42 samples obtained during summer months are presented in Table 1. Incidence of samples containing staphylococci, *Staphylococcus aureus* and *Staphylococcus epidermidis* was higher in summer than in winter. A chi-square test indicated that the difference in incidence of *Staphylococcus epidermidis* and *Staphylococcus aureus* between summer

TABLE 1. THE INCIDENCE OF STAPHYLOCOCCI IN COTTAGE CHEESE OBTAINED IN CONSUMER MARKETING CHANNELS

Season	No. of samples examined	Samples containing staphylococci		Samples containing <i>Staph. epid</i> <sup>a</sup>		Samples containing <i>Staph. aureus</i> <sup>b</sup>		Samples containing both <i>Staph. epid</i> & <i>Staph. aureus</i>		Samples containing phage typeable <i>Staph. aureus</i>	
		no.	%	no.	%	no.	%	no.	%	no.	%
Winter	24	11	45	11	45	1	4	1	4	1	4
Summer	42	24	57	24	57	8	19	8	19	3	7
	66	35	53	35	53	9	14	9	14	4	6

<sup>a</sup>*Staphylococcus epidermidis* (Mannitol negative; Coagulase negative; anaerobic growth positive)

<sup>b</sup>*Staphylococcus aureus* (Mannitol positive; Coagulase positive; Anaerobic growth positive)

Note: Three of the 8 summer samples contained *Staph. aureus* which were phage typeable; one winter sample contained *Staph. aureus* which was phage typeable.

and winter samples was not significant even at .10 level. The exact test by 2 x 2 contingency table under the hypothesis of equality of proportions also showed nonsignificant differences between summer and winter samples containing staphylococci. Thus, no significant seasonal trend of staphylococcal contamination in cottage cheese was found.

Data in Table 2 show counts of S-110 and TG agar obtained during the manufacture of 9

batches of short-set and long-set cheese. Counts when the curd was cut in the short-set method, were less than the initial staphylococcal count on both S-110 and TG agar. The staphylococci were almost entirely confined to the curd portion. During the cooking operation, the staphylococcal population decreased nearly 100%. No evidence of multiplication of the organisms was found during the storage at different temperatures for 6 days.

TABLE 2. NUMBER OF STAPHYLOCOCCI PRESENT DURING VARIOUS STEPS OF COTTAGE CHEESE MANUFACTURE AND STORAGE

Trial no.	Mfg. method	Plating media used	Initial staph. count	Staph count at cutting curd & whey	Staph count at cutting whey curd	Staph count at end of cooking whey curd	Staphylococcal count per g after									
							32	48 hr at 40-50 (°F)		96 hr at 70		144 hr at 70				
			(per ml)	(per ml)	(per ml)	(per g)	(per ml)	(per g)								
1	Short set	S-110 TG	15,450 13,450	7,650 9,700	0 0	66,550 144,500	0 0	40 0	10 0	0 0	0 0	10 0	0 0	0 0	0 0	0 0
2	Short set	S-110 TG	460,000 810,000	93,800 111,900	0 0	75,400 59,900	0 0	30 0	100 0	55 0	1,550 0	0 0	0 10	10 0	0 0	0 0
3	Short set	S-110 TG	1,225,000 2,664,000	270,250 162,450	1,050 1,000	260,000 137,000	20 0	10 0	0 0	0 0	0 0	0 0	0 0	10 0	0 0	0 0
4	Short set	S-110 TG	400,300 460,000	198,500 304,000	0 0	14,000 288,000	0 0	55 0	0 0	0 0	0 0	200 0	305 135	290 0	0 0	0 0
5	Short set	S-110 TG	16,950 21,100	10,500 3,100	0 0	11,495 8,000	0 0	220 0	0 0	0 0	0 0	10 0	0 0	0 0	0 0	0 0
6	Long set	S-110 TG	17,250 20,050	4,600 1,700	0 100	3,600 2,650	0 0	10 0	10 0	10 0	0 0	0 0	0 0	0 0	0 0	0 0
7	Long set	S-110 TG	18,650 6,600	10,400 80,350	0 2,100	2,440 1,840	0 0	0 0	0 0	0 0	105 0	0 0	405 0	10,500 305	4,590 0	Cont Cont
8	Long set	S-110 TG	4,900 8,250	8,000 8,000	200 300	1,285 1,110	0 310	0 0	100 0	0 0	125 40	0 0	900 10	30 30	0 10	0 0
9	Long set	S-110 TG	247,000 206,500	2,120,000 555,000	5,550 4,700	56,000 220	0 0	0 0	110 0	65 10	0 60	155 0	60 0	0 0	0 0	0 0

The staphylococcal count at curd cutting time, with long-set cheese, generally increased except in the 6th trial. The total population increased twelve fold in 7th trial on TG agar and eight times in 9th trial on S-110. Comparing counts in curd and in whey showed the staphylococcal population greater in the curd than in the whey. Unlike in the short-set method, significant numbers of organisms were present in the whey. Most were in the curd and a few in the whey. In two cases (7th and 9th trials on TG agar) organisms were more numerous in the whey than in the curd. Organisms present in curd and whey were fewer than at cutting. The cooking operation almost completely destroyed the organisms. No clear evidence of multiplication of staphylococci during storage was noticed. Staphylococci present in some cases may have resulted from sampling error or contamination.

Particularly noteworthy was the wide variation in counts on the two media. The inhibitory effect of S-110 on heat-shocked staphylococci has been reported earlier (3) but whether TG agar also inhibits heat or acid-shocked organisms is not definitely known.

No correlation between the pH and the counts on either medium or between pH and percentage of coagulase-positive organisms could be determined.

Wilson, et al. (15) have suggested that a minimum population of 500,000 coagulase-positive staphylococci per g is required to produce sufficient toxin to cause food poisoning. In the work reported here only one lot of cheese (Trial 9) showed multiplication exceeding 500,000 per g. The initial count in this batch was more than 200,000 per ml. Such a heavy contamination is not likely to be encountered during the normal processing of cottage cheese. However the organisms are capable of multiplying in the long-set method.

The organisms might multiply to produce enough enterotoxin even from light contamination. Subsequent population reduction during cooking and storage could leave enough organisms in the cheese to make it unsafe.

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## TRAINING OPPORTUNITIES FOR THE SANITARIAN<sup>1</sup>

### THE GRADUATE APPROACH

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Qualified sanitarians now have more opportunities and more support for graduate education than at any time since the development of this professional category.

When considering the graduate approach to training opportunities the use of the terms "qualified" and "sanitarian" must be clearly understood. Many forms of the term "sanitarian" are now widely used by employing agencies as job titles. Educational requirements for these positions vary from high school graduation to a masters degree. As such, the term "sanitarian" is not an indication of academic achievement as are physician, engineer, nurse, veterinarian, dentist and similar designations which are clearly defined in terms of completion of a specific academic curriculum. The term "qualified", as used here, then will refer to qualifications for admittance to a graduate school, not to the title sanitarian. In a few cases these may be the same, but generally, today, they are not and because of this many persons, using the title and working as sanitarians, find themselves without the educational preparation required for admission to a graduate school.

The possession of a baccalaureate degree, even with a good grade average, does not necessarily mean that a person is "qualified" to undertake a specialized program of graduate study. Readiness for graduate work must be demonstrated by academic achievement in the proposed area of study. A sanitarian has been defined as a professional person qualified by education and experience to control environmental factors for the optimum health and comfort of mankind (1). Today, and increasingly so in the future, the control of the environment requires the application of scientific knowledge to the problems encountered. Therefore, to be "qualified" for graduate study in the environmental sciences, a sanitarian should have sound educational preparation in the basic sciences. Forty semester hours with reasonable distribution among physics, chemistry, mathematics,

and biology and with performance at the "B" level or better is generally a minimum. What then are the opportunities and support for graduate education available to such qualified sanitarians?

#### OPPORTUNITIES

Most Schools of Public Health admit qualified sanitarians to graduate study in the environmental sciences. Schools with specialized graduate programs in dairy science, food-technology, entomology, air hygiene, industrial hygiene, radiological health, institutional environment and related areas also will admit qualified sanitarians.

The fourteen Schools of Public Health in North America are approved by the American Public Health Association to award the degree Master of Public Health (M.P.H.). Some of these schools also award the degree Master of Science in Public Health (M.S.P.H.). The principal difference between the two degrees is one of professional experience. Admission to study for the M.P.H. degree requires that, in addition to meeting the academic standards, applicants have a graduate professional degree or three years of acceptable professional experience. Only the academic requirements must be met for the M.S.P.H. degree. Generally, a qualified student can complete the work for either of these degrees during one academic year although some take longer. Study toward higher degrees such as the Ph.D. or Dr.P.H. also is open to persons holding masters degrees or other advanced degrees and who possess the ability to undertake a doctorate program. At the present time two sanitarians are enrolled in such a program at the University of North Carolina, School of Public Health. Study in a doctoral program generally requires a higher degree of specialization than that for the masters degree. A sanitarian reaching this level generally will lose his identity as such, and become identified with a specialty.

The acceptance rate for sanitarians in Schools of Public Health is approximately at the median for 13 categories as shown by the data in Table 1. At one School of Public Health over a recent 5-yr period more masters degrees were awarded to sanitarians

<sup>1</sup>Presented as a part of a Symposium on Training Opportunities for Sanitarians at the Annual Meeting of the INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, INC., at Philadelphia, Pennsylvania, October 24-27, 1962.

TABLE 1. APPLICATIONS AND ACCEPTANCES OF VARIOUS CATEGORIES OF STUDENTS BY SCHOOLS OF PUBLIC HEALTH FOR THE ACADEMIC YEAR 1961-62<sup>a</sup>

Category	Number applying	Number accepted	Rate of acceptance
Statisticians	114	88	77.2%
Physicians	550	423	76.9
Nutritionists	88	65	73.9
Nurses	186	130	69.9
Health Educators	341	235	68.9
Engineers	47	32	68.1
Dentists	79	49	62.0
Sanitarians	199	123	61.8
Biologists, Medical technologists, Microbiologists, etc.	123	74	60.2
Veterinarians	49	27	55.1
Chemists	35	19	54.3
Hospital Administration	307	93	30.3
Other	156	107	68.6
<b>TOTAL</b>	<b>2274</b>	<b>1465</b>	<b>64.4</b>

<sup>a</sup>Taken from: James L. Troupin. Report on Schools of Public Health in the United States and Canada 1961-1962. A Committee Report. American Public Health Association.

than any other category of students registered in the Department of Sanitary Engineering. Table 2 shows the distribution of these graduates by professional categories over the 5-yr period, 1958-1962. At the School of Public Health at the University of North Carolina a qualified sanitarian applicant for study toward a masters degree has never been refused admittance. The records show, then, that qualified sanitarians have opportunities for graduate academic training equal to those of the other professional disciplines.

Sanitarians sometimes undertake graduate study in an area of public health work other than the environmental sciences. This may be done because

TABLE 2. PROFESSIONAL CATEGORIES OF STUDENTS AWARDED MASTERS DEGREES IN THE DEPARTMENT OF SANITARY ENGINEERING, SCHOOL OF PUBLIC HEALTH, UNIVERSITY OF NORTH CAROLINA FOR THE PERIOD 1958-1962.

Professional category	Year degree awarded					Total
	1958	1959	1960	1961	1962	
Sanitarian	7	6	7	7	9	36
Sanitary Engineer	7	6	6	6	7	32
Sanitary Chemist and Biologist	3	6	4	4	6	23
Other-Air Hygiene, Rad. Health, etc. <sup>a</sup>		2	1		1	4
<b>TOTAL</b>	<b>17</b>	<b>20</b>	<b>18</b>	<b>17</b>	<b>23</b>	<b>95</b>

<sup>a</sup>Category established 1959.

students expect their duties, after graduation, to be administrative or educational. Others may follow this route because their undergraduate academic education has not prepared them adequately to do graduate work in the environmental sciences. Still others may wish to follow a more highly specialized course of study. Apparently, however, only a small number of sanitarians undertake graduate programs outside the field of environmental health. Table 3 shows that this was the subject area of major study for 43 of 50 sanitarians graduating from Schools of Public Health last year.

TABLE 3. MAJOR SUBJECT AREA OF GRADUATE STUDY FOR 50 SANITARIANS GRADUATING FROM SCHOOLS OF PUBLIC HEALTH IN 1961-1962.

Major subject area	Number of sanitarians
Environmental health	43
Public health administration	4
Public health education	3
<b>TOTAL</b>	<b>50</b>

Data from: James L. Troupin. Report on Schools of Public Health in the United States and Canada. 1961-1962. A Committee Report. American Public Health Association.

SUPPORT

Support for graduate training of sanitarians refers principally to financial support. Today, by the time many persons are ready for graduate education they

TABLE 4. SOURCES OF SUPPORT FOR ALL CATEGORIES OF STUDENTS REGISTERED AT THE SCHOOL OF PUBLIC HEALTH, UNIVERSITY OF NORTH CAROLINA. 1958-1962.

Source of support	Number of students	Per cent
Federal government traineeships and other grants.	524	62
State and local government traineeships, salaries, and other grants.	120	14
Other: personal, voluntary agencies, foundations, religious and professional organizations, etc.	199	24
<b>TOTAL</b>	<b>843</b>	<b>100</b>

have acquired dependents and incurred other continuing money obligations which make it impossible for them to leave a job and return to school unaided. The Federal Government, state and local government, colleges and universities, foundations, volunteer agencies and industry all have recognized this need and

are meeting it by offering traineeships, grants, assistantships, scholarships and similar forms of assistance to qualified students. Table 4 shows the sources of student support at one School of Public Health during a recent 5-yr period.

Support for sanitarians in the country as a whole compares favorably with that for all disciplines at North Carolina. Table 5 shows this information for sanitarian graduates from Schools of Public Health in 1961-1962.

TABLE 5. SOURCES OF SUPPORT FOR SANITARIAN GRADUATES FROM SCHOOLS OF PUBLIC HEALTH 1961-1962.

Sources of support	No. of sanitarians	Per cent
Federal government	31	62
Employing agency <sup>a</sup>	12	24
Personal	7	14
TOTAL	50	100

<sup>a</sup>Probably largely state and local government.

Data from: James L. Troupin. Report on Schools of Public Health in the United States and Canada. 1961-1962. A Committee Report. American Public Health Association.

The nature of support available to sanitarians for graduate academic training varies widely. State and local governments may make educational grants, continue an employee on full or partial salary while on educational leave, or pay tuition and fees. It can be seen from Tables 4 and 5 that apparently less than one-fourth of the support for education in public health comes from state and local governments.

Beginning in 1936, under Title VI of the Social Security Act, the Federal Government has provided support of one kind or another for graduate education in public health.

In 1956 the Public Health Traineeship Program was established as Section 306 of the Public Health Service Act. It is administered by the Division of General Health Services, Bureau of State Services, United States Public Health Service. Under it the Surgeon General is authorized to award traineeships for graduate or specialized public health training, either directly to individuals whose applications have been accepted by the public or non profit institution providing the training, or through grants to such training institutions. The primary aim of this program is to bring new people into the field of public health by providing post graduate training opportunities for men and women who have completed their basic professional education. It is designed to supplement and not to replace or reduce the training activities currently being sponsored by state and local governments. Since it is the intent of this

activity to bring new people into public health, preference has been given to qualified individuals under 35 years of age who have had not more than two years of public health experience and less than one year of graduate or specialized public health training. Exceptions to this policy are granted only under very special circumstances.

The financial level of the awards under the Public Health Service Traineeship Program is adequate to enable a sanitarian with dependents to return to

TABLE 6. DISTRIBUTION BY PROFESSIONAL CATEGORY OF INDIVIDUALS RECEIVING PUBLIC HEALTH TRAINEESHIPS DURING THE ACADEMIC YEAR 1961-1962 (3)

Professional category	No. of traineeships awarded
Nurses	192
Sanitary engineers	77
Physicians	53
Health educators	38
Sanitarians	33
Miscellaneous	30
Dentists	18
Laboratory personnel	14
Sanitation field (Other)	12
Nutritionists	11
Veterinarian	7
Statisticians	5
Dental hygienists	4
Medical social workers	2
TOTAL	496

school for graduate study. The usual stipend for graduate study at the masters level is \$250 per month with an additional \$30 per month allowed for each

TABLE 7. SCHOOLS SELECTED FOR GRADUATE STUDY BY SANITARIANS AWARDED FEDERAL TRAINEESHIPS IN 1961-1962 UNDER SECTION 306 OF THE PUBLIC HEALTH SERVICE ACT (3).

School	No. of sanitarians selecting school indicated
University of California, Berkeley	9
University of North Carolina, Chapel Hill	7
University of Minnesota, Minneapolis	4
University of Oklahoma, <sup>a</sup> Norman (Dept. of Sanitary Sci.)	3
University of Puerto Rico, San Juan	3
Tulane University, New Orleans	3
University of Michigan, Ann Arbor	2
Georgia Institute of Technology, <sup>a</sup> Atlanta (Public Health Department)	1
University of California, Los Angeles	1
TOTAL	33

<sup>a</sup>Departmental administrative unit rather than a School of Public Health.

dependent. In addition the actual cost of tuition and fees is paid and some assistance is given toward personal travel costs of the trainee. Traineeship awards generally are for a period of one academic year, although special exceptions may be made.

During the academic year 1961-1962, 33 sanitarians and 12 other workers in the field of sanitation received Public Health Service Traineeships. Table 6 shows this information for other professional categories. All but two of the 33 sanitarians receiving traineeships attended Schools of Public Health. Table 7 shows the distribution of trainees among schools. Sanitarian recipients of the fellowship awards were from 16 states and 2 territories.

#### SUMMARY AND CONCLUSION

There are many opportunities for graduate professional education open to sanitarians. During the academic year 1961-1962, 61.8% of the sanitarians applying to Schools of Public Health were accepted. For the same period sanitarians received 6.6% of the Public Health Traineeships awarded. At one School of Public Health, 36% of the students receiving masters degrees with majors in the environmental sciences were sanitarians. Any sanitarian qualified to undertake graduate work in his professional category can find support.

Professional status for the sanitarian, as for any

other group, must be built upon a foundation of education. Most professional education today is at the graduate level, and the current trend in that direction is growing stronger all the time. Yesterday, we worked in parts per million, today we cope with micromicrocuries; what will it be tomorrow? Training tomorrow's sanitarians to meet today's problems is not enough. Graduate education prepares the sanitarian to meet tomorrow's problems as well as today's.

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## ENUMERATION OF PSYCHROPHILIC MICROORGANISMS<sup>1</sup>

### A REVIEW

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The importance of psychrophilic microorganisms in quality control, sanitation and processing of milk products has fostered a growing interest in methods of their enumeration.

The literature on psychrophilic microorganisms was reviewed briefly by Doetsch and Scott (20) and comprehensively by Davis (19), Thomas (43), Ingraham and Stokes (25), and Witter (52). The purpose of this paper is to summarize the more pertinent information about the enumeration of psychrophilic microorganisms.

One of the first problems which arises is that of finding a precise, yet sufficiently comprehensive, definition for these organisms. Many definitions have

been proposed, but as yet no single definition is universally accepted. These definitions are discussed by Witter (52) and Ingraham and Stokes (25). Methods of enumerating psychrophilic microorganisms are as numerous as their definitions, since definitions are used as a basis for establishing counting procedures. Consequently, the problem of the one "best" method of enumerating psychrophilic microorganisms is still unsolved.

#### PLATE COUNT INCUBATION TEMPERATURE AND TIME

Temperature and time of incubation for determination of psychrophiles by the agar plate method seem to be the subjects of greatest debate. The eleventh edition of Standard Methods for the Examination of Dairy Products (9) recommends holding plates at 41-44.6 F (5-7 C) for 7-10 days. The

<sup>1</sup>Journal Paper No. J-4473 of the Iowa Agricultural and Home Economics Experiment Station, Ames, Iowa. Project No. 1050.

recommended incubation time and temperature have changed with each edition of this publication, indicating that no single procedure or definition has yet been suggested which has remained acceptable to the majority of workers in this field. The third and fourth editions of Standard Methods of Milk Analysis (1, 2) made no provisions for psychrophilic counts. One plate incubation temperature and time combination, 99.5 F (37.5 C) for 48 hours, was recognized as the standard for all counts. The fifth edition (3) lowered the temperature to 98.6 F (37 C), but the time of incubation remained the same. As psychrophilic organisms gained more attention, the need for their selective enumeration was seen. The sixth edition (4) suggested "tentative" standards of 68 F (20 C) or room temperature incubation for 72 hours. The seventh edition (5) known as Standard Methods for the Examination of Dairy Products, recommended holding plates at 77 F (25 C) for 4 days. This temperature was reduced considerably in the eighth edition (6). A temperature of 41-50 F (5-10 C) for time sufficient to permit visible colonies to develop was recommended. The time was usually 10 to 14 days or longer. The time was established at 10 to 14 days in the ninth edition (7), but the temperature remained unchanged. The temperature and time combination suggested in the tenth edition (8) in 1953 was 41 F (5 C) for 7 days. As has been mentioned previously, the standards are now 41-44.6 F (5-7 C) for 7-10 days (9).

Many temperature and time combinations for plate incubation other than those noted above can be found in the literature. Thomas (43) listed 28 temperature and time combinations as used by various workers; the temperatures range from 32 to 77 F (0 to 25 C), and times range from 3 to 28 days of incubation. Pennington (37) in 1908 made a study of milk stored at 29.0 to 31.0 F (-1.67 to -0.55 C). Plates were incubated at 68 F (20 C) for 5 days and at 29.0 to 31.0 F (-1.67 to -0.55 C) for a month to 6 weeks. For milk stored less than 4 weeks, 68 F (20 C) incubation gave the highest counts. If the milk had been stored 4 weeks or longer, the lower temperature of incubation yielded counts almost as high as were obtained at 68 F (20 C). In some cases higher counts were obtained at the lower temperature.

Ingraham and Stokes (25) proposed 32 F (0 C) for 2 weeks as a suitable plating temperature and time. Mikolajcik and Burgwald (30), using Tryptone Glucose Extract Milk Agar, found that with plates incubated at 32-35 F (0-1.66 C), 7 days were required for colonies to become visible. At 36-40 F (2.2-4.4 C), 5 days were required. Only 3 days were required to produce visible colonies at 45-50 F (7.2-10 C).

An incubation temperature of 37.4-41 F (3-5 C) has been used frequently for psychrophilic plate counts. Thomas *et al.* (46) used Yeastrel Milk Agar plates incubated for 7 days at 37.4-41 F (3-5 C). Druce and Thomas (21) stated that the psychrophilic colony count obtained at 37.4-41 F (3-5 C) for 7 days provides information on the total number of Gram-negative spoilage bacteria. They believed that, since lactic streptococci will not grow at 37.4-41 F (3-5 C), a colony count at this temperature is more useful than one at 86 F (30 C). The possibility of combining psychrophilic and lipolytic counts by using Tributyrin or Triolein Agar incubated for 14 days at 37.4-41 F (3-5 C) was suggested. Thomas and Chandrasekhar (44) compared counts obtained at 37.4-41 F (3-5 C) for 7, 14 and 21 days. Geometric means for the respective times were 8,412, 67,190 and 91,190. The 14 day counts were eight times the 7 day counts, and the 21 day counts showed a 50% increase over the 14 day counts. Thomas *et al.* (45) compared counts obtained from plates incubated at 37.4-41 F (3-5 C) for 10 days with counts obtained from plates incubated at 44.6  $\pm$  0.9 F (7  $\pm$  0.5 C) for 10 days. The 44.6 F (7 C) counts usually were higher, with only 12 of 177 samples giving lower counts at 44.6 F (7 C) than at 37.4-41 F (3-5 C). Counts at 44.6 F (7 C) were one to five times higher than the counts at 37.4-41 F (3-5 C) for 98 of the samples, including 50 samples whose counts were less than two times higher at 44.6 F (7 C) than at 37.4-41 F (3-5 C). Counts at 44.6 F (7 C) were 10 or more times higher for 40 samples, including nine samples whose counts at 44.6 F (7 C) were more than 100 times the counts at 37.4-41 F (3-5 C). The greater increases were obtained with samples giving low colony counts at 37.4-41 F (3-5 C).

A temperature of 41 F (5 C) for 7 days or longer has been used quite frequently for psychrophilic plate counts. Andrey and Frazier (10) and Overcast and Skean (35) incubated plates at 41 F (5 C) for 7 days. Boyd *et al.* (14) determined psychrophilic counts using an incubation temperature and time of 40 F (4.4 C) for 20 days. One difficulty encountered with incubation at 41 F (5 C) for 7 days is that colonies sometimes are so small that counting is made difficult. Johns (27) stated, however, that after 10 days the colonies are frequently many times larger. Boyd *et al.* (15) compared counts on commercially pasteurized milk from plates incubated at 41 and 50 F (5 and 10 C) for 7, 10, 15 and 20 days. Incubation at 41 F (5 C) for 7 days was discontinued because the colonies were small and difficult to count. In all other cases, 41 F (5 C) yielded lower counts than did 50 F (10 C). Maximum counts at either temperature were not reached in



less than 20 days of incubation. Glenn (23) reported that incubation for 14 days at 41 F (5 C) often resulted in considerably higher psychrophilic counts than did incubation for 7 days at 41 F (5 C). In many cases, after 7 days of incubation, the colonies were too small to be counted. After 14 days, the colonies were larger and easier to count in every instance.

Van der Zant and Moore (48), plating on Tryptone Glucose Extract Agar, incubated plates at 77 F (25 C) for 2 and 3 days, 69.8 F (21 C) for 2, 3 and 4 days, and 50 and 41 F (10 and 5 C) for 5, 7 and 10 days. At all temperatures, they found counts to be higher at the maximum incubation time than at the shorter times. At 41 F (5 C) for 5 days, counts averaged 51% of the 10-day counts; the counts at 7 days averaged 70% of the counts after 10 days incubation. At 50 F (10 C) incubation, the counts after 5 days averaged 82% of the 10-days counts; the 7-day counts averaged 89% of the 10-day counts. These workers agreed with other workers previously cited in that incubation at 41 F (5 C) for 7 days frequently resulted in colonies so small as to make counting difficult. They concluded that incubation for 3 days at 77 F (25 C) was best for enumeration of psychrophiles.

Heather and Van der Zant (24) plated pure cultures of heat-treated and nonheated psychrophilic bacteria on Tryptone Glucose Extract Agar. Incubation was at 77 F (25 C) for 2 and 3 days, 59 F (15 C) for 3, 5 and 7 days and 41 F (5 C) for 5, 7 and 10 days. Lower numbers were found at the shorter incubation times, especially with the heated cells. Heated psychrophiles were detected best at 77 F (25 C) for 3 days and at 59 F (15 C) for 7 days.

Nelson and Baker (31) incubated plates at 95 F (35 C) for 2 days, 89.6 F (32 C) for 2 days, 77 F (25 C) for 2 and 3 days, 69.8 F (21 C) for 2, 3 and 4 days, 59 F (15 C) for 3, 4 and 7 days, 50 F (10 C) for 4, 5 and 7 days and 41 F (5 C) for 5, 7 and 10 days. Of the samples plated at 41 F (5 C), the average count at 7 days was 81% of the count at 10 days. In all cases incubation at 77 F (25 C) for 3 days detected samples giving high counts on plates incubated at 41 F (5 C) for 10 days. Therefore, it was recommended that plates be incubated at 69.8 F (21 C) for 4 days or 77 F (25 C) for 3 days for the detection of milk with a high bacterial count due to growth during refrigeration.

Witter (52) stated that psychrophiles are capable of forming visible colonies on plates incubated for 10 days at  $44.6 \pm 0.9$  F ( $7 \pm 0.5$  C). Olson *et al.* (33, 34) and Schultze and Olson (42) used 44.6 F (7 C) for 10 days. Comparisons of 44.6 F (7 C) for 10 days with other temperatures and times have been

reported above. Kaufmann and Andrews (28) plated on Tryptone Glucose Extract Agar containing 0.2 per cent yeast extract and incubated at 47 F (8.3 C) for 7 days. Jezeski and Macy (26) compared total, lipolytic and caseolytic counts using 98.6 F (37 C) for 2 days, 68 F (20 C) for 5 days and 46.4 F (8 C) for 7 days. They reported that 68 F (20 C) incubation resulted in the highest counts. Burgwald and Josephson (17) determined psychrophilic counts on Tryptone Glucose Extract Milk Agar incubated at 46.4-50 F (8-10 C) for 10 days.

Kennedy and Weiser (29) plated raw and pasteurized milk and held the plates at 50 F (10 C) for 24, 48 and 72 hours. Their results showed that, as the time of incubation increased, the number of colonies on plates of both raw and pasteurized milk samples increased. This increase was considered to have possibly resulted from either slow growing psychrophiles or mesophilic bacteria which had become adapted to growth at 50 F (10 C) during the 72 hour incubation period.

Erdman and Thornton (22) compared counts from plates incubated at 95.9 F (35.5 C) for 2 days, 50.9 F (10.5 C) for 7 days and 40.1 F (4.5 C) for 7 days. The 40.1 F (4.5 C) counts were lower than the 95.9 F (35.5 C) counts while the 50.9 F (10.5 C) counts varied from 36 to 350 per cent of the 95.9 F (35.5 C) counts. The differences never were considered to be greater than the experimental error of the plate method. Subsequent work indicated that incubation at 95.9 F (35.5 C) did not adequately enumerate psychrophilic organisms, because colonies isolated from the plates incubated at 40.1 (4.5 C) and 50.9 F (10.5 C) were inhibited at 95.9 F (35.5 C). Atherton *et al.* (12) found that organisms from commercially pasteurized milk grew equally well on plates incubated at 68, 78.8, and 89.6 F (20, 26 and 32 C), and that the counts at 50 F (10 C) were only slightly lower.

Many workers believe that incubation of plates at 50 F (10 C) does not give a true representation of the psychrophilic content of milk, since thermophilic organisms may grow on these plates. Olson *et al.* (34) stated that incubation at 50 F (10 C) will result in the growth of thermophilic bacteria not encountered at 45 F (7.2 C). Atherton *et al.* (11) found that organisms surviving laboratory pasteurization showed little growth up to 15 days in milk held at 45 F (7.2 C) but that marked growth occurred at 50 F (10 C). Boyd *et al.* (14) picked colonies which had appeared on plates between 10 and 15 days at 50 F (10 C) and compared their pasteurization resistance with that of colonies which appeared before 10 days. Thirty-two and one-half per cent of the isolates appearing before 10 days withstood pasteurization at  $141.8 \pm 0.9$  F ( $61 \pm 0.5$  C) for

30 minutes, and 82.5 per cent were able to grow at 41 F (5 C). On the other hand, 100 per cent of the cultures isolated after 15 days incubation withstood pasteurization and only 17.9 per cent were able to grow at 41 F (5 C). It was concluded that the increase in count from 10 to 15 days incubation was due to thermophilic microorganisms and that, therefore, 50 F (10 C) is too high to detect true psychrophiles which are considered to be killed by proper pasteurization. Thomas *et al.* (45) found that no organism from laboratory pasteurized samples grew at 44.6 F (7 C) and concluded that incubation at 44.6 F (7 C) was adequate for detecting post-pasteurization contamination. Other workers (18, 21, 29, 34, 36, 41, 43, 44, 47, 49) also thought that the presence of psychrophilic bacteria was due to post-pasteurization contamination rather than to thermophilic microorganisms.

Some workers favor higher temperatures for estimating numbers of psychrophilic microorganisms. Prouty (38) recommended holding plates at 62.6 F (17 C) for 5 days for the enumeration of "facultative psychrophiles." Weber (50) believes that incubation at 68 F (20 C) was more adequate than 95 F (35 C) for determining bacterial content of milk held in cold storage. Watrous *et al.* (49) stated that incubation at 77 F (25 C) gives the most useful information on refrigerated dairy products. Other workers (24, 31, 48), in determinations previously described, recommend 77 F (25 C) for 3 days, or some comparable temperature and time combination.

#### PRODUCT DETERIORATION AND NUMBERS OF PSYCHROPHILIES

Several workers have attempted to correlate numbers of organisms with flavor changes in milk or by observing some metabolic activity of the psychrophilic bacteria. Olson *et al.* (33) stated that, at a given temperature, the rate of deterioration in a product depends not only on the initial numbers but also on the types of organisms in the product. For this reason, using counts to predict keeping quality or bacterial activity to estimate numbers has not been completely successful. According to Atherton *et al.* (12), there is little relationship between the psychrophilic population and off-flavor development, but changes in flavor are due more to bacterial types than numbers. However, Boyd *et al.* (15) found a definite relationship between flavor deterioration and bacterial increase. At 40 F (4.4 C) the psychrophilic count was 26,800,000 per ml when the flavor score went below 37, and, at 33 F (0.6 C), the count was 2,500,000 per ml when the score dropped below 37. Pennington (37) held milk at 29.0 to 31.0 F (-1.67 to -0.55 C) for as long as 6 weeks and found no off-odor or taste even when psychrophilic counts

were in the hundreds of millions. Punch *et al.* (40), working with pure cultures, determined counts at the time off-flavors were detected. They reported the following ranges of organisms per ml: *Pseudomonas*, 5.2-200 million; *Alcaligenes*, 2.5-14 million; *Flavobacterium*, 8.3-120 million; coliforms, 2.7-150 million; and yeasts, 2.5-14 million. Weese and Henderson (51) studied the relationship between flavor deterioration, acidity development and bacterial numbers in refrigerated pasteurized milk. Samples of commercially pasteurized milk were held in home refrigerators varying in temperature from 37 F (2.8 C) to 52 F (11.1 C). There was little decrease in flavor score or little increase in acidity until after 4 days. The number of cells increased rapidly after storing for 3 to 4 days. Burgwald and Josephson (17) found acidity development definitely correlated with psychrophilic growth. Atherton *et al.* (11) found little change in acidity or pH of commercially pasteurized milk after storage at 40 F (4.4 C). Change in flavor was slow, even with rapidly increasing bacterial numbers; dye reduction was slow and no significant increase in phosphatase occurred. The first perceptible indication of deterioration appeared to be a loss of stability of casein. Babel (13) reported that acidity and amino nitrogen increase slowly in milk held at 40 F (4.4 C). Van der Zant and Moore (48) found no direct relationship between bacterial population level and proteolytic activity but increases in soluble nitrogen, tyrosine and tryptophan were noticeable when cell counts reached  $10^5$ - $10^6$  organisms per ml.

#### OTHER ENUMERATION PROCEDURES

Punch and Olson (39) proposed a surface plate method for the enumeration of psychrophiles. Samples were spread over the surface of agar, and the plates were incubated at  $42.8 \pm 0.9$  F ( $6 \pm 0.5$  C). After 5 days incubation, counts were equal to or greater than those obtained by incubating at 41-44.6 F (5-7 C) for 7-10 days. Advantages claimed in addition to the reduced incubation time were that colonies were more easily counted and that spreading colonies were avoided.

A membrane filter technique for enumeration of Gram-negative bacteria was suggested by Nutting *et al.* (32). Filters containing Yeast Extract Glucose Medium were inoculated and incubated at 69.8 and 50 F (21 and 10 C). Colonies were stained with methylene blue and observed at a magnification of 30 times. It was found that maximum colony numbers developed in 12 hours at 69.8 F (21 C) and 72 hours at 50 F (10 C). Counts were in reasonably good agreement with agar plate counts obtained at corresponding incubation temperatures.

Broitman *et al.* (16) proposed a keeping quality

test based upon the activity of psychrophilic microorganisms. The test used Nacconol-tri-phenyltetrazolium chloride in milk which was incubated at 68 F (20 C) and observed at 12-hour intervals for 48 hours. A positive test after 12 hours incubation indicated a shelf life of 4 days for milk held at 40.1 F (4.5 C). Positive tests at 24, 36 and 48 hours indicated a shelf life of 9, 12 and 15 days, respectively. These workers stated that initial counts could not be used to predict keeping quality except that milks with populations of 10 or fewer organisms per ml would have long shelf lives.

#### SUMMARY

The many methods which have been proposed for enumerating psychrophilic microorganisms indicate a lack of agreement on the subject. The problem seems to stem from the fact that each worker has his own definition of psychrophilic bacteria and uses a procedure which is dependent on the definition. These differences of opinion are clearly reflected in the changes in recommended time and temperature of plate incubation in successive editions of "Standard Methods for the Examination of Dairy Products." The adoption of one time and temperature combination by all workers would be desirable from the standpoint of providing a basis for comparison of work done in different laboratories. To accomplish this, we will have to resolve the difficult task of agreeing on a standard definition of psychrophiles.

#### ADDENDUM

Since this review was prepared the following came to our attention: Leesment and Dufeu (16th Int'l. Dairy Congr. C:392-398. 1962) accelerated the development of colonies of psychrophilic bacteria by preincubating plates for 16 hr at 62.6 F (17 C) before further incubation at 44.6 F (7 C) or 39.2-42.8 F (4-6 C). Psychrophilic plate counts after 4 or 5 days coincided well with counts obtained after incubation for 10 or 20 days using the standard method.

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## COTTAGE CHEESE PROBLEMS IN PRODUCTION AND SANITATION

### QUALITY CONTROL IN COTTAGE CHEESE<sup>1</sup>

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Most of the spoilage occurring in cottage cheese is microbial rather than chemical. The organisms involved are usually psychrophiles that cause surface slime, or yeasts and molds. In general psychrophilic organisms are restricted to the genera *Pseu-*

*domonas*, *Alcaligenes*, *Flavobacterium* and *Achromobacter*, with the first two being the most frequent causes of spoilage. These organisms produce pigmented slime or gelatinous film along with objectionable flavors and odors (5).

Spoilage by molds occurs less frequently but is extremely objectionable. The molds most commonly encountered are *Geotrichum candidum* which produces an off-white or light tan to yellow color,

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species of *Mucor* which are usually gray and quite filamentous, and species of *Penicillium* which are blue-green to gray.

The yeasts most frequently involved in cottage cheese spoilage are species of *Rhodotorula* that cause vivid pink spots and eventually pink slime, and species of *Torulopsis* that produce a yellow slime.

#### SOURCES OF CONTAMINATION

Water is a much more important source of contamination than many processors and sanitarians realize. Water supplies, both municipal and private, which are examined at regular intervals and declared "safe" by technicians in health department laboratories, actually may be grossly contaminated with psychrophiles. These laboratories frequently limit their tests to the determination of coliforms, the presence of which may be associated with pathogens. Frequently water supplies are coliform free but may contain substantial numbers of psychrophiles commonly associated with food spoilage. Cheese washed with contaminated water will be thoroughly and uniformly contaminated. These organisms are non-fastidious in their nutritive requirements and may be present in large numbers in pipe lines and vats used for storage of water. Several inches of organic sediment have been found in water reservoirs used to supply dairy plants.

Water supplies examined in representative butter and cottage cheese plants in Michigan (6) usually contained < 1 coliform per ml but frequently contained several hundred or thousand psychrophiles per ml. Counts on water samples taken at or near the place where the water entered the plant or reservoir were usually much lower than counts on samples taken where the water entered the vat or churn. Sections of hose or pipelines, such as those used to run cold water into vats or churns, are frequently submerged in the whey or buttermilk and spoilage organisms may gain access to plant water systems through these lines. Sanitary pipe which can be removed and sanitized should be used for this purpose.

Equipment is second to water in importance as a source of contamination. Many of the psychrophilic organisms most frequently involved in spoiling dairy products are more or less indigenous to dairy products and are found in and on poorly sanitized equipment.

Contamination from air, dust and condensation can be a significant hazard to keeping quality. These particles are blown about by air currents created by the movement of personnel and mechanical equipment and are deposited on exposed products or equipment. Microbial counts on samples of air,

or on nutrient agar plates exposed in processing rooms attest to the significance of this type of contamination.

Additives such as the creaming mixture or chopped vegetables may be an important source of contamination. The latter may be an especially significant source of coliforms.

#### COOKING TEMPERATURE AND DESTRUCTION OF SPOILAGE ORGANISMS

Careful and uniform agitation is important. In commercial practice cooking temperatures usually range from 120 to 140 F with holding times of 20 to 30 minutes or perhaps longer. Usually we use high cooking temperatures with high acid (low pH) cheese and also with curd formed from milk which has been subjected to high pasteurization temperature. During cooking there is some destruction of organisms, the amount of which is related to temperature and pH. The lethal time-temperature requirements for relatively resistant strains of *Escherichia coli*, *Pseudomonas fragi*, *Streptococcus cremoris* and *Streptococcus lactis* were determined by Collins (4). Using hypothetical but logical assumptions of initial populations and numbers to be tolerated in the finished cheese it was shown that a minimum cooking temperature of 130 F and a minimum holding time of 18 min were required to accomplish sufficient destruction of *E. coli* and *P. fragi*. This would also destroy most of the streptococci but these are not particularly important in spoilage of refrigerated products.

Bonner and Harmon (2) reported that none of the 12 species of bacteria representing five genera, which had been isolated from spoiled cottage cheese, survived heating at 120 F for 15 min in whey at pH 4.55. These were random strains of organisms, not selected for resistance, and were heated in whey only, in which the thermal resistance is probably less than it would be in a mixture of whey and curd. Chaudhary *et al.* (3) reported that the spoilage organisms *Pseudomonas viscosa*, *Pseudomonas fluorescens* and *P. fragi* did not survive cooking at 120 F for 30 min. There was a decrease of 90% in the population of these organisms during setting and cutting, which was attributed to sensitivity to the acidity being developed by the starter.

#### MICROBIAL POPULATIONS IN COTTAGE CHEESE

There is an extreme variation in the microbial populations normally encountered in commercial cottage cheese. Thirty-five samples of cheese obtained from Michigan plants immediately after the cheese was packaged contained from < 1 to 1300 coliforms per g and the psychrophile counts ranged

from 20 to 3,600,000 per g (7). Only five of the samples contained less than 1000 psychrophiles per g and only one contained less than 100 per g. Only seventeen of the samples contained < 10 coliforms per g. The yeast and mold counts varied from < 1 to 17,000 per g and 18 contained < 100 per g. The counts on 48 samples of cheese purchased from retail markets in Michigan were considerably higher, ranging from < 1 to 1,200,000 coliforms per g, 30 to 920,000 yeast and mold per g and 800 to 190,000 psychrophiles per g. Four market samples contained < 10 coliforms per g and four contained over 100,000 per g. The above data were obtained in 1954 and 1955. Substantial improvement has probably been made since that time.

In a similar study of cheese quality in Tennessee, Overcast and Slean (11) found coliform populations in fresh cheese ranging from < 1 to 715,000 per g, yeast and mold counts of < 1 to 750,000 per g, and psychrophile counts ranging 200 to 546,000,000 per g.

Angevine (1) reported that 66 samples of fresh cheese from three different plants had total counts ranging from 3,000 to 7,400,000 per g, coliform counts of < 1 to 14,000 per g and yeast and mold counts of < 1 to 13,000 per g.

The effect of psychrophilic contamination on keeping quality was demonstrated by Zimmerman and Kester (14) who found that the surface spoilage defect was consistently produced in 5 to 7 days at 50 F by inoculating the cheese with < 10 causative organisms per g.

#### PREDICTING SHELF-LIFE

It is important for the manufacturer to be able to anticipate the shelf-life of the products which he merchandises. Various incubation tests are used for this purpose. One of the several different time and temperature combinations recommended for incubating samples of cottage cheese to estimate shelf-life involves holding the cheese at 72 F for 2 or 3 days. This time and temperature combination is relatively useless in ascertaining the presence of psychrophiles. Even though this temperature is in the optimum range for growth of psychrophiles, lactic organisms, particularly streptococci and lactobacilli, usually out-number the spoilage organisms in cottage cheese. At temperatures of 60 F or above the lactics promptly overgrow the psychrophiles and produce sufficient acid to reduce the pH below the level tolerated by the psychrophiles. This type of spoilage is distinctly atypical from that which would occur under normal storage conditions.

The author recommends an incubation temperature of 55 F for 3 to 5 days to detect cheese with

a predisposition to spoilage by psychrophiles. In cheese with a normal pH of 5.1 to 5.3 the psychrophiles will over-grow the lactics at the above temperature if the psychrophile contamination is sufficient to be a major factor in spoilage.

Reduction tests commonly used on raw milk supplies have been used to assess the quality of various other food products. A modified reduction test has been developed to predict the shelf-life of cottage cheese (8). This test has some of the limitations common to all reduction tests, however, a statistical analysis of the data resulting from the examination of 101 commercial samples of cheese show the method is useful, particularly for identifying cheese with short shelf-life. Some of the problems related to developing the test were: (a) the psychrophiles have long generation times, (b) they are relatively weak in their ability to reduce dyes, (c) they are sensitive to low pH and (d) in a dairy product they are usually over-grown by streptococci or lactobacilli. To overcome these limitations and enhance the accuracy of the reduction test, bile salts no. 3 (Difco) were added to inhibit the Gram positive lactic organisms, trypticase soy broth was added to the diluted cheese to stimulate the growth of the psychrophiles, the cheese samples were neutralized to a pH of  $6.5 \pm 0.5$  and incubated at 75 F. Nineteen of 20 samples of cheese which produced an organoleptically detectable defect within 48 hours when stored at 50 F reduced resazurin to pink in 7.75 hrs or less. All samples requiring more than 23 hours to reduce resazurin retained satisfactory quality for 6 or more days when stored at 50 F.

#### IMPORTANCE OF pH IN CONTROLLING PSYCHROPHILES

Data from a study of the relationship between pH and growth rate of several psychrophiles identified with spoilage of cottage cheese show that the growth rate is usually much less at a pH of 5.2 or lower than at a pH of 5.4 and above (2). The consumer wants a bland cheese therefore we should exploit methods of reducing the pH of the cheese without incorporating the sour flavor which accompanies high acid cheese. This can be done by making cheese with as much acid as is consistent with consumer acceptance, acidifying wash water, and addition of culture to the creaming mixture if the manufacturer can be certain the creamed cheese will be effectively refrigerated until consumed. Some manufacturers have added acids such as lactic, citric or phosphoric to the creaming mixture but this must be done carefully after the cream is refrigerated to avoid curdling.

The pH of municipal and private water supplies

usually ranges from 7.5 to 10.0, depending on local conditions and previous treatment. Washing cheese with alkaline water will raise the pH of the curd. The acidification of wash water prior to chlorination at the rate of about 5 ppm is common practice and has the dual advantage of permitting much more effective microbial destruction and reduces the pH of the cheese about 0.1 to 0.2 of a unit. The pH of the water should be reduced to between 5.0 and 6.0 and carefully controlled. If the pH of the water is lower than the iso-electric point of casein (about 4.7) the wash water may cause significant damage to the physical character of the curd. Also, the lower the pH the greater the corrosion caused by the chlorinated water. The wash water system must be so arranged that the chlorine will have some residence time in the water to accomplish microbial destruction. It is futile to chlorinate the water as it enters the cheese vat because the organic matter (cheese) in the vat inactivates the chlorine.

It is important to have adequate refrigeration for the wash water. At the conclusion of a proper cooking procedure there should be a minimum number of organisms present in the cheese. From this point on it is important to minimize contamination and refrigerate the cheese promptly to prevent the growth of any contaminants. Two or perhaps three wash waters may be used. Excessive washing causes a bland or even flat flavor. The first water should be about 45 to 50 F and the second water should be as near 32 F as possible. The cheese can be cooled more quickly and effectively with water than by any other method. Some manufacturers are reducing the temperature of the curd to as low as 40 F with water and certainly the curd should be cooled to 45 or 50 F by this method.

The creaming mixture can also be an effective cooling agent. A common blending ratio is one part of creaming mixture to two parts of curd. Creaming mixtures usually contain 3 or 4% salt and therefore can be cooled to 26 or 27 F prior to adding to the curd. If two parts of curd at 45 F and one part of cream at 27 F are blended, then theoretically the temperature of the creamed cheese would be 39 F, except for the loss of refrigeration due to friction and handling in non-refrigerated equipment. Admittedly this is idealistic, however there are manufacturers following this practice who are putting cheese into the package at 45 F or lower. This together with prompt efficient subsequent refrigeration is extremely important and can make a difference of many days in shelf-life. Spoilage organisms of greatest concern to the cottage cheese industry grow fairly well at 48 to 50 F and very slowly at 40 to 42 F.

#### MISCELLANEOUS FACTORS INFLUENCING QUALITY OF COTTAGE CHEESE

Mather and Babel (10) have reported on a method which involves the inoculation of creaming mixtures with cultures of *Leuconostoc* species for the purpose of inhibiting some common psychrophilic spoilage organisms. The inhibition is due to action other than the presence of propionic and acetic acids resulting from the fermentation of citric acid by these cultures, or the reduced pH resulting from acid development by the lactics.

With the increased incidence of staphylococci in milk supplies and the greater danger of infection of food with staphylococci from human sources, it is appropriate for sanitarians to aid in alerting the cottage cheese industry to the danger of holding "slow vats" until coagulation occurs. When antibiotics, bacteriophage or other inhibitory agents are present in the milk starter organisms may be inhibited but there is a possibility that staphylococci, which are most resistant to the antibiotics and non-susceptible to lactic phages, may produce lethal quantities of toxin in slow vats before acid development and coagulation are accomplished by secondary starter organisms.

Floating curd due to the presence of carbon dioxide is one of the problems in cheese manufacture. Starter cultures with associate organisms capable of producing high quantities of biacetyl also produce carbon dioxide as a by-product of the fermentation. Careful selection of cultures will minimize this problem. Sandine *et al.* (12) have shown that troublesome cultures produce 3 to 5 times as much gas as those which do not cause floating curd. There is more apt to be gas in cheese made by the long set at 72 F than when made by the short set at 90 F because the gas producing associate organisms do not grow well above 80 F. Over-ripening starter used for cottage cheese manufacture is also an objectionable practice because of excess gas production. *Streptococcus diacetylactis* is particularly noted for biacetyl and CO<sub>2</sub> production and has a higher optimum temperature than the leuconostocs. Starters containing this organism should be avoided in cottage cheese manufacture.

Tsantilis and Kosikowski (13) compared the keeping quality of cheese packaged under normal atmosphere, vacuum, nitrogen and carbon dioxide. Carbon dioxide was the most effective in extending keeping quality, followed by nitrogen, vacuum and normal atmosphere.

In recent years numerous claims have been made in behalf of the beneficial and therapeutic effect of "sea water salt." This propaganda has extended to the merchandising of salt for use in the food in-

dustry. It has been shown (9) that sea water salt has no effect in improving the shelf-life or microbiological or organoleptic quality of cheese.

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**SPECIAL FEATURE****OUR HERITAGE — 50 YEARS IN RETROSPECT**<sup>1</sup>

The Second Decade 1921-31

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Dr. C. K. Johns, former president of the International Association of Milk and Food Sanitarians (1934-35), is a native of London, England and moved to Montreal, Canada in 1910. Dr. Johns has been very closely aligned with milk sanitation throughout his career with the dairy industry.

Following overseas service during World War I, he began working on a farm and later attended the School of Agriculture, Olds, Alberta. He earned his bachelor's degree (B.S.A.) in 1925 from the University of Alberta. As the recipient of the Macdonald Scholarship, he attended Macdonald College in 1925-26. He received his master's degree from McGill. His formal academic education was completed in 1937 when he received his Ph.D. degree from the University of Wisconsin.

At the time Dr. Johns began working on his academic degrees, he was associated with the Grande Prairie Creamery, first as a butter-maker in the summer and later as manager, and with the Edmonton City Dairy. Following his master's work, he was employed as a

bacteriologist with the Alberta Dairy Branch in Edmonton until August, 1927. He then began employment with the Division of Bacteriology, Canada Department of Agriculture, Central Experimental Farm, Ottawa.

Dr. Johns has been very active in milk sanitation with special emphasis on chemical sterilization, tests for bacteriological quality, care of milking machines, and is best known for his studies on lye soak solution for milking machine rubber parts, the resazurin triple reading test for milk, and preliminary incubation of samples before testing.

The IAMFS Citation Award was presented Dr. Johns in 1954. Since 1938, he has served as a member of the Committee on Standard Methods for the Examination of Dairy Products, APHA. He is currently chairman of the Subcommittee on Thermaduric Thermophilic and Psychrophilic Bacteria. In 1943, Dr. Johns became a Fellow of American Public Health Association and in 1950, a Fellow of the Agricultural Institute of Canada.

In 1959, when the Dairy Technology Research Unit became autonomous and was renamed Dairy Technology Research Institute, he was appointed director. He now holds the position of head of the Dairy Section, Food Research Institute, Canada Department of Agriculture.

<sup>1</sup>The second of a series of reports covering each of the five decades of the INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, INC.

<sup>2</sup>President of IAMFS, 1935



**His appointment as the Canadian representative on the FAO-WHO Joint Expert Committee on Milk Hygiene (Geneva, Switzerland, 1956 and 1959) is exemplary of his achievement in the field of dairy sanitation.**

This was a period of steady growth. By 1931 there were 271 members, compared with 97 in 1920 and 105 in 1921. In 1931 Dr. Paul B. Brooks, who succeeded the late Ivan C. Weld as Secretary-Treasurer, suggested changing the name from the INTERNATIONAL ASSOCIATION OF DAIRY AND MILK INSPECTORS to one more aptly descriptive of the membership. The milk inspector was being recognized as more of an educator than a policeman, and men employed by industry now outnumbered the official inspectors. This resulted in the establishment of an associate membership class for the industry man.

Probably the most important single event of this decade was the untimely death of our first Secretary-Treasurer, Ivan C. Weld, March 1929. Weld, an outstanding individual, was generally regarded as the "king-pin" of the Association. At the 1929 Annual Meeting heartfelt tributes were paid him for his work as our first Secretary-Treasurer. For 17 years he undertook the preparation of the Annual Report without any remuneration, and much of the Association's success in the early years can be credited to his unstinting efforts. At a mock trial at the 1923 Annual Meeting, Weld was found guilty of working too hard and playing too little! He was sentenced to play golf frequently and presented with a set of clubs for this purpose. He was indeed a great man.

Looking over the Annual Reports of that decade, certain things seem predominate. There was much greater concern over milk-borne disease, as well there might have been. (In 1926 in the United States there were 3363 cases with 95 deaths, while in the Montreal typhoid epidemic of 1927 there were 5110 cases with 537 deaths!) Control of bovine T.B. was making steady progress, and brucellosis was receiving increasing attention. Mastitis was also causing concern, but principally because of epidemics of septic sore throat resulting from udders infected by the milker.

Pasteurization was not nearly so common in that period. Although Toronto had compulsory pasteurization in 1914, and Chicago in 1916, considerable amounts of raw milk were still being sold. In 1921, 65% of the milk sold in up state New York was raw. Certified milk, which had pioneered improved milk sanitation, was beginning to be questioned. In 1923, Leslie C. Frank, U. S. Public Health Service, asserted that the fundamental idea of certified milk was wrong, and that all milk, including certified, should be pasteurized. During this period the Public Health Service conducted extensive tests on commercial holder pasteurizers at Endicott, N. Y., and uncovered

some serious defects. High-temperature, short-time pasteurization had to fight hard to overcome the bad reputation of the older "flash" pasteurization, but by 1931 several types of tubular HTST pasteurizers, as well as the plate type, were approved by New York state and Pennsylvania authorities.

Back in 1922 dairy bacteriologists were disturbed over "pin point" colonies on plates from pasteurized milk. This led to the discovery of thermophilic bacteria able to grow in milk during holder pasteurization. Thermophilic bacteria presented a serious problem, especially for the larger plants, until HTST equipment became available. J. W. Yates, then of Kansas City, H. A. Harding and A. R. Ward, of Detroit, all active members of this Association, did pioneer work in this field.

Most milk ordinances had been developed by the local inspector, and they were rarely based on reliable data. Often requirements in one market were in conflict with those in another. There was increasing recognition of the need for more uniform standards and regulations. The Public Health Service came into the picture in Alabama, where, under the leadership of Leslie C. Frank, (President 1941) the Standard Milk Ordinance and Code got its start.

During this period milk sanitarians began to show an interest in ice cream. Investigations showed startlingly high counts and insanitary conditions and the need for placing this product under better sanitary control was recognized.

The value of laboratory examination of milk as a supplement to inspection was gradually being recognized with the direct microscopic (Breed) count and methylene blue reduction tests being most widely used for controlling raw milk for pasteurization. Interestingly enough, the need for certification of plating media was recognized that early, and from 1923 on the Committee on Laboratory Methods was instructed to pass upon the acceptability of dehydrated media. (This is of particular interest today in view of the current opposition to certification of media.)

During this decade, the work of Harding *et al.* at Illinois, which showed that utensils, especially milking machines, were the real source of heavy bacterial contamination of milk, began to be generally accepted. In 1927, M. J. Prucha discussed "Chemical Sterilization in the Dairy Industry," with particular reference to hypochlorite, and this method of sanitizing equipment soon became accepted both on the farm and in the plant.

From its inception, the Association attracted most of the leading men in milk sanitation. Meetings were well attended, and evening sessions were general. Discussion of papers was free and frank, and often added greatly to their value. During this

period a number of men took a prominent part in the Association's activities, including C. A. Abele, G. E. Bolling, Paul B. Brooks, Howard Estes, Leslie C. Frank, Geo. W. Grim, H. A. Harding, Ira V. Hiscock, Ralph E. Irwin, Ernest Kelly, Sydney Leete, W. B. (Bill) Palmer, Horatio Newton Parker, W. H. Price, Geo. W. Putnam, James Houston Shrader, Thos. J. Strauch and Ivan C. Weld. Most of these men served as president at one time or another, and all of them served the Association well. They have all left us in their debt. I would like to say a word or two about several of these men. C. A. Abele's contributions over many years are generally known. Since he joined the Association in 1923, Abe has been most active in its affairs. We all owe him a great debt of gratitude. Dr. Paul B. Brooks, despite his heavy duties as Deputy Commissioner of Health for New York State, made time to undertake the expanding duties of Secretary-Treasurer, following the tragic loss of Ivan C. Weld. As a former president, I can testify what a tower of strength Dr. Brooks was to me. Bill Palmer, who was president in 1932, was another man who sacrificed a great deal for this Association. To him we are largely indebted for starting the Journal of Milk Technology, and for carrying the heavy load of Managing Editor without remuneration until his untimely death in 1951. With his name I would couple that of James Houston Shrader, who teamed up with Palmer to serve as Editor from 1937 until 1954. He also served as Secretary-Treasurer from 1946 to 1948 and contributed generously of his time, skill and wisdom.

Palmer and Shrader were the first recipients of the Citation Awards in 1951 followed by C. A. Abele in 1952. Horatio Newton Parker, a New Englander who had migrated to Jacksonville, Florida, was one of the "elder statesmen" who made a big contribution to the Association. In addition to serving as President in 1933, he was Chairman from 1927 to 1932 of the Committee on Communicable Diseases Affecting Man and was an active member of various other committees. He left the Association still more deeply in his debt by undertaking to prepare an index of all annual reports from 1912 to 1936. He was a wise, kindly person who was sorely missed when he passed away.

I could go on mentioning name after name, but limitations of space forbid. The Association has been well served in the past by men such as those mentioned. Their successors will be hard put to excel them.

During the period under review the international character of the Association was quite evident. Three Canadians, Drs. Hollingsworth of Ottawa (1924), Shoultz of Winnipeg (1927), and Richmond of Toronto (1931), served as presidents. In 1922, a member of the Royal Sanitary Institute, Ernest A. Evans, presented a paper on "Sanitation and the Milk Supply of London," while papers of a similar nature were presented in 1923 by F. Rosinek of Czechoslovakia, and Dr. Masayushi Sato of Japan, and The Honorable Tasnyoon Philip Sze, Vice-Consul of the Republic of China, at New York.

# News and Events

## FOOD AND DRUG OFFICIALS TO HOLD CONFERENCE IN JUNE

The Association of Food and Drug Officials of the United States (AFDOUS) has scheduled June 16 through 20, 1963, for its Sixty-seventh Annual Conference, to be held at the Jack Tar Hotel, Lansing, Michigan.

AFDOUS President, Vincent R. Stewart, state chemist of Florida, announced early in March that

in addition to a welcome by Governor George Romney and a keynote address by Mr. G. S. McIntyre, Michigan director of agriculture, those attending the conference will hear discussions on current problems confronting food and drug officials.

Top authorities will present papers on combatting quackery in medicine, advertising health products, deceptive packaging legislation, food chemicals standards, food plant inspections, and other related and pertinent subjects.

George P. Larrick, commissioner of the Federal Food and Drug Administration, will present a report on activities of the agency he heads in the area of consumer protection.

AFDOUS is the professional society of food and drug enforcement officials in all levels of government. The Annual Conference offers the officials the opportunity to study mutual problems, review activities and exchange points of view, stated President Stewart.

An attendance of over 300 officials and food and drug industry representatives is expected.

## Former President, IAMFS, Dr. J. G. Hardenbergh, Dies,

Dr. John G. Hardenbergh, 70, past-president of the International Association of Milk and Food Sanitarians (1937), died February 11 in his home in Arlington, Virginia.

In September, 1958, he retired from the position of Executive Secretary of the American Veterinary Medical Association, a position he had held since 1941. From 1958 until his death, he served as a consultant to AVMA. In 1959, Dr. Hardenbergh was presented the Annual AVMA Award in recognition of his distinguished service as executive secretary as well as for his valuable contributions to the veterinary profession. He was also presented the Award of Merit by the General Alumni Society of the University of Pennsylvania for a distinguished career and service to the University.

He received his V.M.D. degree from the University of Pennsylvania in 1916 and was associated with the Gilliland Laboratories, Inc., Marietta, Pennsylvania, following graduation until he began a two-year term with the Army Veterinary Corps in 1918. From 1924 to 1936, he served as a captain in the Veterinary Reserve Corps.

Dr. Hardenbergh was associated with the American Public Health Association for several years.

Survivors include his wife, Sue, and two sons, James and Robert. Full military services were held in Virginia, February 14.

## DAVID HARTLEY CONDUCTS FLORIDA TRAINING SESSION

David E. Hartley, N A M A public health counsel, recently conducted a one-day training school for Florida sanitarians.

The school, sponsored by the Florida State Board of Health, was held in West Palm Beach, Florida, January 24, and was attended by some fifty state and local public health officials.

Hartley said the school's purpose was to explain the state's new vending sanitation regulation adopted there in June, 1962. N A M A worked on the regulation with Florida authorities. The regulation follows N A M A recommendations and is uniform with the U. S. Public Health Service Ordinance and Code.

Robert T. Cozart, Jr., Automatic Merchandising, Inc., Tampa, and Doug Hunter, Hunter Vending Co.,

West Palm Beach, assisted Hartley in conducting the school.

Also this month, Hartley met with officials of the Pennsylvania State Health Department and Alan Morrison, Morrison Vending Service, Inc., Hanover, president of the Pennsylvania Automatic Merchandising Council (P A M C) to discuss setting up a state sanitation regulation for food and beverage venders. Hartley said recommendations followed the U. S. Public Health Service Ordinance and Code.

He said P A M C soon will mail questionnaires to Pennsylvania operators to determine the number and types of food and beverage venders in the state. In addition, a special P A M C committee soon will be appointed to maintain vending industry liaison with the State Board of Health.

Pennsylvania Automatic Merchandising Council is an affiliate of National Automatic Merchandising Association.

## Two Dairy Products Conferences Are Held At Purdue University

F. N. Andrews, Head of the Animal Sciences Department at Purdue University, and F. J. Babel, professor-in-charge of the Dairy Manufacturing Section, have announced two, one-day meetings were held in March, 1963. The Market Milk Conference was held on March 20 and the Ice Cream Conference on March 21, in the Memorial Center at Purdue University. The conferences are an annual affair sponsored in cooperation with the Indiana Dairy Products Association.

The Market Milk Conference included discussions on the Fundamentals of Cottage Cheese Manufacture; Propagation of Cottage Cheese Cultures; Trouble Shooting — Cultured Products; Managing Men, Milk and Markets; Federal Milk Marketing Orders; and Off-Flavors of Milk and Their Removal. The program was concluded with a milk and cottage cheese clinic.

The Ice Cream Conference featured discussions on, A New Merchandising System for Ice Cream Manufacturers; Operation of the Votator Freezer; Production of Fine Quality Ice Cream; Design and Layout of Refrigeration Systems; and The Advantages of Gas Refrigeration. The luncheon featured a discussion of Uses of University Extension Centers in Personnel Training. The program was concluded with an ice cream clinic.

Dairy industry authorities and leading dairy technologists from Purdue and other midwest universities participated in the program. Further information on the programs may be obtained from Mr. H. F. Ford, Smith Hall, Purdue University, Lafayette, Indiana.

## FEATURE

# HOW TO INSPECT A FOOD PROCESSING PLANT

VINCENT T. FOLEY, CHIEF, FOOD SECTION  
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It has been said, and rightly so, that a journey of a thousand miles starts with a single step. In order for a sanitarian to make an inspection of a food processing plant he must first go to the plant. While this may seem like a naive statement we have only to note the many food plants operating without the benefit of inspection by any regulatory agency. Many such agencies have excellent milk and restaurant programs but ignore food processing plants operating within their jurisdiction. The reasons given for not inspecting these plants are usually, "we have never inspected them" or "we don't have sanitarians competent in that particular field."

Obviously, the excuse that they have never been inspected is certainly no reason why they shouldn't be. Equally without foundation, is the statement that a regulatory agency does not have men trained to inspect the various food processing plants. Any sanitarian, worthy of the name, possessing a well rounded background in his chosen profession, can do an accreditable job inspecting food processing plants. While it is true many of the manufacturing details of the various food processing procedures will be new to the sanitarian, it is equally true that many of the sanitary problems encountered in a food processing plant inspection are similar or identical to those encountered in restaurant inspections.

For example, rat stoppage of a large food plant would be just as necessary as rat stoppage of a restaurant building. The mechanics involved would be the same in both cases, only the magnitude of the job would be different. Items such as floors, walls and ceilings, fly control, lighting, ventilation, toilet facilities, water supply, lavatory facilities, disposal of wastes, refrigeration, wholesomeness of food and drink, storage of ingredients and cleanliness of employees are restaurant items that can, almost without exception, be applied to food manufacturing establishments.

## Preparing for the inspection

In addition to the usual thermometers, flashlight and notebook normally carried by sanitarians, some additional inspectional aids are needed. A white smock, similar to those worn in meat plants, and a white paper or cotton hat or cap is a necessity and should be worn while inspecting the plant. There are other aids that could be used, such as ultraviolet light and cameras, but these items are not generally used in making routine inspections.

Before entering any plant it is advantageous to examine the exterior of the building. Look for unscreened open doors, open dock doors and unscreened windows presenting entrances into the plant for rodents, insects and birds. The condition of the building, particularly as to rodent stoppage measures should also be observed. The area immediately surrounding the plant should be neat and clean, otherwise this area may provide harborage for insects and rodents that could gain entrance into the plant.

## Methods and procedures

Upon entering the plant it is important that the sanitarian contact the man in charge of the plant, usually the plant manager. If this is your first inspection of the plant, introduce yourself and advise him of the purpose of your visit.

Do not expect to be greeted with open arms, particularly if this is the sanitarian's first inspection of the plant. Explain to the manager that this is to be a routine inspection and that there will be periodic inspections to follow. Advise him that it is the intent to assist him in maintaining a clean and sanitary plant and that the policy of the regulatory agency the sanitarian represents is to resort to court action only when the plant officials have refused to voluntarily make the necessary corrections to bring their plant into a sanitary condition. However, the plant manager should be advised that the health agency or department does prosecute violators when necessary.

While talking to the plant manager it is advisable to ask if he has a member of his staff available to participate in the inspection of the plant. If the plant has a sanitarian he will invariably accompany the inspector, otherwise a foreman will usually be asked to perform this duty.

The actual inspection of the plant should begin where the various ingredients are brought into the plant and stored. The ingredient storeroom acts as a barometer, foretelling the sanitary condition of the plant. If the storeroom is in disarray it is likely that the plant will be in somewhat the same condition. Conversely, a clean and neat storeroom presages a clean and sanitary plant. All food ingredients should be inspected for purity and wholesomeness. If the ingredients are found to be contaminated by insect infestation, rodent pellets, foreign matter or by any other adulterant they should be condemned. All ingredients should be stored off the floor and neatly stacked on skids. The skids

should be arranged in such a manner as to permit easy accessibility for cleaning and should be at least 18 inches from the walls. Look diligently for insect and rodent infestation in the storeroom area. However, do not assume simply because the plant has bait stations for rodents that the plant has a rodent infestation. This may be a precautionary measure. Evidence of rodents should be substantiated by the finding of rodent excreta or other positive evidence.

Every item of sanitary interest should be recorded in your notebook. This would include the commendable practices as well as those that could be improved. This should be done throughout your inspection of the plant. When leaving the storage area the flow of the food ingredients can be followed through the plant in their normal course of manufacture until the finished product has been packaged and is stored awaiting shipment out of the plant. Here, it should be noted that every inspection of food processing plants should be performed with thoroughness. Do not hurry your inspection. Take whatever time is necessary to do a competent job.

As you progress through the plant, observe the plant personnel. All male workers should wear clean, preferably white, pants and shirts and either caps or hats. Their hands should be clean at all times. For this reason, handwashing facilities in addition to those for the toilets should be located in or near the production area. Women workers should wear clean, light colored smocks or other appropriate clothing, and should wear hair nets in the production area. Any violations concerning personal habits or dress of the employees should be noted, but it is inadvisable to discuss the violation with the concerned employee or the employee accompanying you on the inspection. This matter can be handled objectively by incorporating it into your inspection report, listing the violation without pinpointing the person involved and placing the responsibility for correction on the plant officials, where it rightly belongs.

As the inspection progresses through the plant, the cleaning of equipment and floors should be noted. In both cases, look for buildup or accumulation of ingredients, foreign matter, or product either in or out of its normal place. Any evidence of abnormal buildup of ingredients, either on floors or equipment that obviously did not accumulate during the current day's operation, should be marked as a violation. Do not consider the daily soiling of the floors and equipment, due to operational procedures, as violations. In many plants the cleanup crew goes to work after production is over for the day and works through the night. Hard to reach areas, such as under and behind equipment, are one of the true indicators of a plant's sanitation program. If these areas are clean the plant cleanup personnel are do-

ing an excellent job, under competent supervision.

The area in which the finished product is packaged usually presents fewer problems for the sanitarian than the production area. In general, the packaging and shipping room problem is one of good house-keeping.

Upon completion of the inspection of the plant, the employee accompanying the sanitarian should be advised that the sanitarian's findings will be incorporated into a letter which will be sent to the plant manager. It is inadvisable to discuss the sanitarian's findings with the plant personnel at this time.

Samples of the finished product for laboratory examination should not be obtained at the plant. Employees, seeing the sanitarian carrying out food, may assume that the laboratory samples are for the sanitarian's personal use. If a finished product sample is needed for laboratory examination it can be purchased through regular channels. Any ingredient samples taken should be placed in the paper or plastic bags brought for that purpose. The bags should be marked with the name of the ingredient, where obtained, name of the plant, the date taken, and should be sealed and signed by the sanitarian. Many food processing plants do not permit glass of any kind to be brought into the food storage and production areas. Glass in food products has been the basis for many damage suits against food processors. To prevent the possibility of the sanitarian breaking a glass sample jar in the plant, paper and plastic bags should be used for this purpose.

Upon leaving the plant, the sanitarian should, at his earliest opportunity, make a written report of his findings based upon the notes taken during the inspection of the plant. Whenever possible, the report should be broken down into areas or floors. For example, the areas listed might include the receiving room, storage area, production area, the packaging room, shipping room and toilet and handwashing facilities. In another plant it might be better to list the areas according to floors. This is a point the sanitarian can determine according to the type of plant inspected.

#### Assessment of conditions

After the violations have been listed, the sanitarian should appraise the overall sanitary condition of the plant and carefully evaluate the items of greatest public health significance. If there are insanitary practices within the plant that present a threat to the health of the consumer, these should be brought to the attention of the plant manager with a heading such as, "For immediate attention and correction." If there are sections of the plant, or practices within the plant, that deserve praise do not hesitate to in-

corporate this into your letter.

When the plant does not have a routine cleaning schedule this should be recommended. If the sanitation is such that followup inspections are needed, these should be scheduled. After the plant is in an acceptable sanitary condition routine periodic inspections should be made to insure that it remains in this condition.

## Author Warns Against Withdrawal Of Chemical Pest Control Practice

"The withdrawal or even curtailment of present chemical pest-control practices would within a single season bring back the 'worm-in-every-apple' and other equally unappetizing commodities to our tables. Along with this would be slow starvation of our population from half-rations, and total disappearance of many foodstuffs."

This opinion is voiced by F. A. Gunther, one of the contributing authors to "Chemical and Biological Hazards in Food," a new book released the week of February 4 by the Iowa State University Press.

The book is a thorough-going appraisal of our present knowledge and the progress being made in solving the chemical and biological problems of hazards to our food supply. Twenty-two distinguished scientists, including some of the world's foremost authorities on chemical and biological hazards in foods, contributed their appraisals to the volume which is the outgrowth of the *International Symposium on Food Protection* held last summer at Iowa State University.

In discussing what are "safe" levels for the public consumption of food additives, A. J. Lehman of the Food and Drug Administration poses the question: "Is there such a thing as a 'no-effect' level for a cancer-producing substance? It will take a lot more work before we have the answer."

He concludes his discussion with "the thought that has been expressed many times — 'The way not to have cancer is not to be born.'"

Gunther, who is a toxicologist at the University of California, feels that, "Technically speaking, the pesticide residue situation is competently and confidently under continuing control . . . the public does not seem to know that all our foods contain pesticide residues, but in amounts of no concern under present watchful legalized use. Harmful amounts are not allowed, and the enforcing agencies are adequate to their task."

"Hazards in Food" was assembled under the editorial direction of John C. Ayres, A. A. Kraft, H. E. Snyder and H. W. Walker, all of the Department of

Dairy and Food Industry at Iowa State University. The authors include experts from the fields of animal physiology, biochemistry, chemistry, engineering, entomology, food science and microbiology, nutrition, parasitology, pharmacology, plant physiology and toxicology.

Major areas of discussion include the use of chemicals in food production and processing, chemicals used in agricultural production, protecting food from pathogenic microorganisms, and microbial toxins.

The editors believe that the information presented in "Hazards in Food" should make it possible to appraise possible food hazards in the broadest sense, and to estimate the safety of our total food supply as never before.

Copies of the book are available from the Iowa State University Press at a cost of \$4.50 each.

## ABSTRACTING SERVICE TO REVIEW LITERATURE OF FOOD TECHNOLOGY

A specialized abstracting service to provide the first authoritative and complete review of the literature in 13 of the most active fields of food technology was announced recently by Lowry-Cocroft Abstracts, 516 Main Street, Evanston, Illinois. The information available through this new abstracting service covers the fields of most importance to food technologists in the American and most foreign literature. (A complete list of the 15 fields covered together with a classification of the food processes abstracted by type of process and by kind of information covered is listed in the attached Appendix.)

The food processing abstracts, as prepared by the Lowry-Cocroft service, are presented and circulated weekly on coded "Unisort" punched cards to greatly speed retrieval of the desired information. Abstract cards are classified by type of food processed . . . vegetables, fruits, meats, poultry, fish, dairy products, and others . . . as well as whether pertaining to legal matters, processing conditions, packaging, storage, nutritive value, etc. (This classification is also indicated in detail in the Appendix.)

At present, approximately 150 foreign and domestic journals in food technology and related fields are covered by this new abstracting service. In addition, searches of U. S. and foreign patents in the food field are made and abstracts prepared. Furthermore, pertinent technical papers offered at meetings will be obtained for abstracting immediately after presentation.

Subscription price for the Lowry-Cocroft Abstracting Service has been announced at \$20.00 per month. It is anticipated that about twenty-five abstracts will be sent to subscribers each week and will be mailed

out within two weeks after the articles become available.

Preparation of the food processing abstracts is directed by Mr. Robert Cocroft, who has wide experience in the food industry as a member of the Accent-International Division of International Minerals and Chemicals Corp. Dr. Charles Doak Lowry, widely experienced in food technology as a research scientist and scientific consultant and an originator of the widely-used Gas Chromatography Abstracting Service, supervises the distribution of this new abstracting service.

## APPENDIX

FOOD PROCESSING ABSTRACTS  
CLASSIFICATION SYSTEM

Food Processing Abstracts are classified by process, type of food covered and kind of information.

The processing fields are:

Pasteurization	Fermentations (excluding
Heat Sterilization	alcoholic beverages)
Freezing	Separation and Refining

Dehydrofreezing	Irradiation
Dehydration	Enzyme Treatment
Freeze Drying	Packing
Preservation with Chemicals (including salt)	Packaging
	Cooking
	Organoleptic Analysis

The types of food processed are as follows:	
Vegetables	Starch
Fruit and Fruit Products	Sugar
Meat	Beverages
Poultry	Oils and Fats
Fish and Shellfish	Spices and Flavorings
Eggs	Prepared Foods
Dairy Products	Diet Foods
Cereals and Soy Beans	

The differentiation by kind of information covered is the following:

Patent	Flavor
Legal	Texture (including tenderness)
Quality Control	Color
Microbiology	Nutritive Value
Time and Temperature in Processing	Antioxidants
Equipment	Emulsifiers and Stabilizers
Storage	Other Additives

Avoidance Of Contaminated Water  
Shown In Health Service Booklet

The United States Public Health Service issued a new publication in February, "Plumbing Cross-Connections," showing how dangers to public health from contaminated drinking water can be averted.

Plumbing cross-connections link pipes carrying drinking water with pipes carrying contaminated water or other harmful liquids. Such connections, occasionally made in ignorance of the possible dangers they pose or in confidence that a valve will not leak, have been found responsible for many outbreaks of disease, and a number of instances are detailed in the booklet.

One "typical" case occurred in a mid-west school. Fire lines including hydrants, although separate from drinking water lines, were connected to the potable water through a valve at a pump house. The source of water for the fire system was a nearby river, which was polluted. In January, 1957, following a fire, someone left the connecting valve open which allowed river water to enter the domestic water supply. About 150 people were stricken with gastroenteritis before the defect was found and corrected. An effective cross-connection program would have prevented the incident.

The new publication, which deals with the public health significance and control of plumbing cross-connections, is a manual of recommended practice, and includes a recommended ordinance.

Wesley E. Gilbertson, chief of the PHS Division of Environmental Engineering and Food Protection, declares in the booklet's forword that plumbing cross-connections comprise a serious public health problem in the United States today, but one which may be controlled through knowledge and vigilance. He points out that every municipality with a public water supply should have a cross-connection control program.

"Plumbing Cross-Connections," designed and produced as a tool for health officials, water works personnel, plumbers and others, will be sold at \$.40 each by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

## HELPFUL INFORMATION

"Some Aspects of Milk Quality after Addition of Dairy Sanitation Chemicals," H. V. Atherton, and R. A. Johnson, University of Vermont, Agriculture Experiment Station, Bulletin 623, Burlington, Vermont.

"Causes and Prevention of Undesirable Flavors in Milk," Alec Bradford, University of Vermont, Agriculture Experiment Station, Bulletin 624, Burlington, Vermont.

"Factors Influencing Butterfat Sampling Accuracy in Bulk Cooled Milk," P. S. Dimick and H. V. Atherton, University of Vermont, Agriculture Experiment Station, Bulletin 626, Burlington, Vermont.

"Sequestrene Food Grade EDTA Products," Geigy Industrial Chemicals, Ardsley, New York.

## SANITARIAN'S AWARD CONTEST ANNOUNCED

EACH OF YOU MUST KNOW A SANITARIAN WHO HAS DEMONSTRATED TO A HIGH DEGREE THE QUALITIES AND CHARACTERISTICS SPECIFIED AS CRITERIA FOR SELECTION OF THE WINNER IN THIS COMPETITION. DO HIM THE HONOR OF ENTERING HIS NAME. NO NEED TO WORRY ABOUT YOUR NOT BEING ABLE TO COMPOSE A STORY THAT MAKES FASCINATING READING. THE SELECTION IS BASED ON FACTS, NOT PRESENTATION. YOUR NOMINEE WILL BE COMPETING WITH SOME OF THE WORLD'S BEST SANITARIANS. EVEN THOUGH HE MAY NOT BE SINGLED OUT AS THE WINNER, HE WILL BE IN A SELECT COMPANY OF UNPUBLICIZED SANITARIANS WHOSE PERSONAL DEDICATION HAS HELPED SAVE MANY LIVES AND EXTENDED THE USEFUL LIFE SPAN FOR A HOST OF OTHERS.

Each year at its Annual Meeting the International Association of Milk and Food Sanitarians makes an award of \$1,000 to the sanitarian selected as outstanding in his performance and as best exemplifying the ideals of his profession. The following rules and procedures have been established governing the competition:

The Award consists of a Certificate of Citation and \$1,000 in cash, and is sponsored jointly by the Di-versey Corporation, Klenszade Products, Inc., Oakite Products, Inc., Pennsalt Chemicals Corporation, and the Olin Mathieson Chemical Corporation. It is administered by the International Association of Milk and Food Sanitarians, Inc., and is presented annually. The next presentation will be at the Annual Meeting of the Association in Toronto next October.

### *Eligibility*

The rules concerning eligibility of candidates for nomination are:

(1) Any living citizen of the United States or Canada who, at the time of nomination, is employed as a professional milk and food sanitarian, or both, by a county or municipality, is eligible for the Award, except members of the Executive Board and members of the Committee on Recognition and Awards of the International Association of Milk and Food Sanitarians, Inc. Employees of State or Federal agencies and of industry are not eligible for the Award. Membership in the International Association of Milk and Food Sanitarians, Inc., is not a prerequisite of eligibility, and there are no restrictions as to race, sex or age.

(2) A candidate shall have made a meritorious contribution in the field of milk and food sanitation to the public health and welfare of a county or municipality within the United States or Canada.

(3) The achievements and contributions on which the Award is to be based, must have been completed during the five-year period immediately preceding January 1 of the year during which the Award is to be made. Under special circumstances, consideration will be given to related work accomplished by the candidate during the seven-year period

preceding January 1 of the year during which the Award is to be made.

(4) Co-workers are eligible for nomination if both have contributed equally to the work upon which the nomination is based.

(5) No person who has once received the Award shall be eligible for nomination.

### *Nominations*

Nominations of candidates for the Sanitarians Award may be submitted by the Affiliate Associations of the IAMFS, or by any member of the Association in good standing except members of the Executive Board, members of the Committee on Recognition and Awards, and employees of the sponsoring companies. Nominations from persons who are not members of the Association cannot be accepted. No member or Affiliate may nominate more than one candidate in any given year.

Each nomination must be accompanied by factual information concerning the candidate, a resume of his work and achievements, evidence supporting his achievements and if available, reprints of publications. A form for the submission of nominations may be obtained upon request from H. L. Thomasson, Executive Secretary, International Association of Milk and Food Sanitarians, Inc., P. O. Box 437, Shelbyville, Indiana.

### *Deadline for Submission of Nominations*

The deadline for submission of nominations is set annually, and all nominations and supporting evidence must be postmarked prior to midnight of that date. The deadline for this year's competition is June 15, 1963.

### *Selection of the Recipient*

The Committee on Recognition and Awards of the International Association of Milk and Food Sanitarians, Inc., has full responsibility for selecting from among the candidates nominated the recipient of the Sanitarians Award. In judging the contributions of each candidate, the Committee will give special consideration to (a) originality of thought, mode of planning, and techniques employed, (b) the comprehensive nature of the candidate's achievements, and (c) their relative value as they affect the health and welfare of the candidate's community. The Committee will give consideration also to the efforts of the candidate to establish professional recognition in the community in which he serves, as well as to his research, administrative development program operation and educational achievements. Additional information or verification of submitted information will be requested when considered necessary by the Committee. Testimonial letters in behalf of a candidate are not desired.

If, after reviewing the nominations and supporting evidence, the Committee decides that the work



and achievements of none of the candidates have been significantly outstanding, the Award shall not be made. In this connection, it is fundamental that if meritorious professional achievement cannot be discerned the Award shall be omitted for a year rather than to lower the standards for selections of a recipient.

## DAIRY SCIENCE PROFESSOR, W. E. GLENN, PASSES AWAY

Dr. Wilburn E. Glenn, 41, assistant professor of Dairy Science, University of Kentucky, died unexpectedly in East Lansing, Michigan, January 5. He was attending Michigan State University on a program of post-doctoral study.

During his sabbatical leave from the University of Kentucky, he planned to devote a year to advanced study in bacteriology. Dr. Glenn and his family moved to East Lansing September 1, 1962.

He joined the staff of the Department of Dairy Science at the University of Kentucky in September 1956 and was assigned to duties of teaching and research in dairy bacteriology.

Dr. Glenn was a native of Oklahoma and received his bachelor of science and master of science degrees from Oklahoma State University in 1948 and 1952, respectively. After receiving his B. S. degree, he was superintendent of dairy plants in Kansas and Arizona before returning to Oklahoma State. On earning his M.S. degree, he served as a research assistant at Washington State University while working for his Ph. D. degree. After receiving this degree, he spent a year on the staff of the Puget Sound Milk Marketing Administration, Seattle, Washington.

While at the University of Kentucky, he authored several professional papers and had a manuscript partially completed for publication. He was a member of Sigma Xi, American Association for the Advancement of Science, American Dairy Science Association, INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, Institute of Food Technologists, Tri-Cities Dairy Technology Society, Toastmaster's Club and an active member of the First Methodist Church in Lexington.

Dr. Glenn is survived by his wife, Mrs. Wanda Glenn, a daughter, Ann Jeanette, and a son, David Mark.

## Surgeon General To Keynote Ninth Interstate Milk Shippers Conference

Surgeon General Luther L. Terry of the United States Public Health Service will be the keynote speaker on April 16, 1963, at the Ninth National Conference on Interstate Milk Shipments at the Hotel Peabody, Memphis, Tennessee.

Approximately 300 representatives of public health and agricultural agencies, the dairy industry, universities, and others concerned with facilitating the interstate movement of fluid milk and milk products of high sanitary quality, are expected to attend.

Park Livingston of the Dean Milk Company, Franklin Park, Illinois, is the National Chairman of the 1963 Conference; Karl Mohr, Green Bay, Wisconsin, is the Conference Program Chairman; and Everett Handorff of the Memphis Tennessee Health Department is in charge of local arrangements.

Task Committees concerned with standards, supervision, rating and certification, state responsibilities, Public Health Service responsibilities, and procedures for handling complaints, will review basic program operating procedures and recommendations for changes submitted by the conferees. Among the subjects scheduled for general consideration are non-biological contaminants in milk and milk products, improved laboratory methods, mastitis control, uniform labeling, dietary milk products, and proposals for standards for Grade A milk powder in consumer packages.

## AMERICAN DAIRY SCIENCE TO CONVENE AT PURDUE IN JUNE

The fifty-eighth annual meeting of the American Dairy Science Association will be held at Purdue University June 16 through 19.

A meeting of the executive board will be held at Purdue Friday and Saturday, June 14 and 15. The past-presidents' dinner and an informal get-together is scheduled for Sunday, June 16.

The June 17, 18 and 19 programs will include general sessions and sectional meetings devoted to discussions of interest to manufacturers, producers and extension. Sectional meetings, including a luncheon Tuesday noon, June 18, are scheduled for students.

At the opening general session on Monday, the group will be welcomed to Purdue by Dr. F. N. Andrews, head of Purdue's Animal Science Department.

Fred Babel, Purdue dairy scientist, is serving as chairman of the local arrangements.

## Reference Guide Published By Library Of Congress

The Library of Congress has just published a new reference guide entitled *International Scientific Organization: A Guide to Their Library, Documentation, and Information Services*. Prepared in the Library's International Organizations Section and financed by a grant from the National Science Foundation, the *Guide* may be purchased from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. at \$3.25 each.

The part played by international organizations in scientific communication is now rather generally recognized and is reflected in an increasing demand for continuing current information about them. Until now, there has been no source which provided much-needed information on the library, documentation, and information services of the majority of organizations—a limiting factor in the free flow of information of scientific interest across national boundaries. To remedy the situation, the National Science Foundation, in 1959, commissioned the Library of Congress to have its International Organizations Section prepare the present guide.

The 794-page volume, compiled under the direction of Katherine O. Murra, reports on the services of 449 scientific, technological, agricultural, and medical organization. It not only describes these services, but also sketches briefly the purpose, structure, administration, and membership of each, and it lists publications by and about them. More than 3100 bibliographical references are given, most of them with annotations. A general index to the services and administrative structure of the organizations is included, and a key to the acronyms is another useful feature.

In preparing the guide, the Library of Congress questioned 781 international organizations about their scientific work and services. From the 683 replies and from careful research in the rich collection of the Library of Congress and other area libraries, 449 international scientific organizations were selected for inclusion; these included both intergovernmental and nongovernmental bodies.

### BABSON X-RAY FILM WINS AWARD

A unique film which brings to the screen for the first time X-ray photography showing milk coming from a cow, has been given a Centennial Film Festival Award by the U. S. Department of Agriculture in Washington, D. C.

Photography experts claimed that the X-ray scene

would have to be shot in a special laboratory under special conditions. However, the film makers, Babson Bros. Co. of Chicago, filmed the movie in a northern Illinois milking parlor.

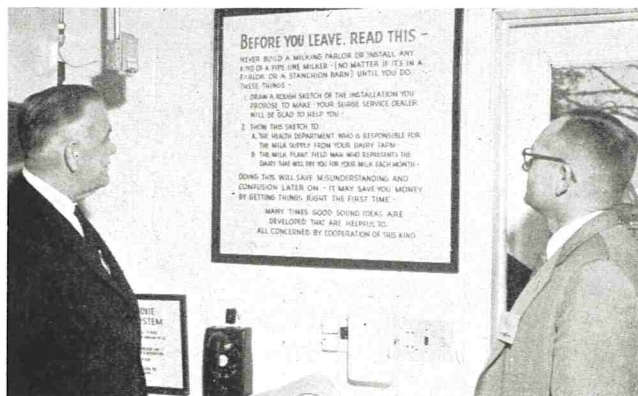
The X-ray photograph was achieved after one quarter of the udder of a cow was infused with a barium compound before milking. The scene plainly indicates an opening between the udder and the teat cistern as long as milk is flowing and the teat cup of the milking machine is held down. This opening closes when the teat cup is allowed to creep up on a partially empty quarter.

The film, "Reminder to Dairymen," also presents efficient milking practices with a stirring message on how to control mastitis in the dairy herd.

Featured in the film is C. W. Turner, internationally known authority on milk secretion and the cow's mammary gland. One of the highlights of the film is the showing of a Babylonian frieze depicting a cow being milked 3,000 B.C. by a man stooped behind her. A short history of the dairy industry is also given.

This award-winning 16mm color movie, which runs for approximately nine and one half minutes, is ready for showing to interested groups working in milk technology and quality control.

Reservations for a free print of the film for showing should be made well in advance of the proposed showing date with alternative dates being given, if possible. Prints should be ordered from Film Department, Babson Bros. Dairy Research Service, 2843 West 19th Street, Chicago 23, Illinois.



Dr. H. E. Erickson (left) and Hugh Munns inspect an important notice at the Surge Training Center near St. Charles, Ill., where they attended a class of the Surge Dairy School, geared to help dairymen and dairy industry officials prepare for a progressive industry in the space age. Dr. Erickson has for 34 years been in quality control work and is now Chief of the Food and Dairy Division of the St. Paul Board of Health. Munns, field service supervisor of the Twin City Milk Producers' Association, is also a Director of the Minnesota Sanitarians Association.



Floyd M. Copenhaver, left, and A. E. "Art" Parker take a good look at the new Surge Water Analyzer, which milking system dealers are using to assist in a complete program of sanitation for the dairy farm. Copenhaver is Chief of the Dairy Section of the Kansas City Health Department. He is also first Vice-President of the Missouri Association of Milk and Food Sanitarians. "Art" Parker as come up through the ranks in quality control and is now Chief, Division of Milk Sanitation for the City of Portland, Oregon.

## KLENZADE SEMINAR STRESSES PRODUCTION STANDARDS

"We are here in the interest of better sanitation and higher standards of food production and processing," expressed the Klenzade Products Seminar Committee concerning their 24th Annual Seminar held this year at the Georgia Center for Continuing Education, University of Georgia, on March 4 and 5.

A thorough and comprehensive program was arranged by the program committee and reflected a concern for many phases of food sanitation. For each segment of the program, which included; *"The Chemistry of Cleaning," "Sanitation Microbiology," "Special Factors in Equipment Cleaning and Maintenance," "Practical Plant Sanitation Programs," "Dairy Plant Sanitation," "Food Plant Sanitation," "Dairy Farm Sanitation,"* and two sessions on *"Automation Cleaning,"* four papers were presented; as panel discussions with well qualified personnel participating.

General meeting topics showing a concern for the total discipline of sanitation and healthful practices, were: *"The Dairy Industry Today,"* by Norman Myrick, Milk Industry Foundation; *"New Concepts of Sanitation in Food Processing,"* by C. S. Brinsfield, Division of Food Control, State Department of Health, Baltimore, Maryland; and *"Applied Sanitation Chemistry,"* by R. B. Barrett, Technical Director, Klenzade Products.

Following the first day of activity, consulting sessions were held and, as in the past, proved worthy

of a prominent position on the annual agenda. Consulting session topics, guided by four consultants, centered around the general areas of chemical and bacteriological aspects of cleaning; sanitation in cultured products manufactured; special plant cleaning problems; modern plant layout; equipment and operation; dairy farm sanitation and automation cleaning.

During the morning session of the opening day's program, Mr. A. L. Shogren, vice-president, Klenzade Products, extended greetings to the guests and was followed by the address of welcome given by O. D. Aderhold, president, University of Georgia.

Included among the speakers at the Seminar were: Messrs. P. R. Elliker, J. J. Powers, W. M. Roberts, D. B. Whitehead, J. J. Sheuring, K. G. Weckel, J. E. Flora, J. B. Smathers, R. B. Douglas and D. A. Seiberling. These men also served as chairmen of the various panels.

The guest speaker at the closing dinner on March 5 was Mr. A. D. Holt, president, University of Tennessee. S. K. Mahood, general manager of Klenzade Products was present and serving as toastmaster for the evening was Dr. H. B. Henderson, Dairy Department, University of Georgia.

The 24th Klenzade Seminar, attended by nearly 400, is acclaimed by many to be a valuable contribution to the food sanitation field. As stated by the sponsoring firm, "Our seminars, educational programs, research and development, technology, materials and services are all designed to contribute to an even higher level of sanitation so essential to modern food quality."

**67TH ANNUAL MEETING**

## DPII Views Problem Of Milk Quality And Product Labels

The controversial subject of testing milk or inspecting farms to obtain satisfactory milk quality and compliance with health requirements was discussed by Dr. A. C. Dahlberg, Cornell University, in the keynote address of the Sixteenth Annual Meeting of the Dairy Products Improvement Institute held February 14 in New York City.

Dr. Dahlberg concluded that the problem is not one of whether to test milk or to inspect farms, but rather one of coordinating the work to attain the best quality milk supply with the least effort and expense.

Mr. E. J. Roberts, director of Farm Supply and Production, Crowley's Milk Company, Binghamton, New York, and retiring DPII president, presided at the luncheon meeting attended by 250 persons.

That something better than the "crepe" label "imitation" should be accorded foods which do not masquerade as something they are not was emphasized by Mr. Charles M. Fistere, general counsel for the Dairy Industry Committee, while discussing problems involved in labeling "substitute" and "imitation" products. Science has pointed a new way to meet a need in the human dietary; consequently, Fistere was critical of the application of the term "imitation" to foods complying with section 403 (J) of the Federal Drug Act.

Emphasis of the importance and necessity of allowing the food processor or manufacturer freedom to develop new foods, new variants of present foods or new ways of presenting products to the public was made by Mr. E. L. Peterson, executive director, Milk Industry Foundation, Washington, D. C. This should be as much the concern of the law maker and the law enforcer as attainment of the ethics of honesty and fair dealing; the food industry and those charged with regulation need to re-examine the philosophy which gives vitality to our industry and our society, suggested Peterson.

Confusion and added expense caused by non-uniformity in dairy product labeling has concerned public officials and the dairy industry for some time. To work toward correction of this problem, the National Labeling Committee was organized and began functioning during 1962. Mr. M. W. Jefferson, Virginia Department of Agriculture and chairman of the Labeling Committee, explained the activities and progress of the Committee at this year's Annual Meeting. Implementation of the Committee and the development of its program was made possible by the DPII through the use of its office facilities

and the services of its Executive Secretary as Secretary of the Committee.

At the Institute's business meeting held in the forenoon, the following directors were elected for a three-year term: A. J. Claxton, Beatrice Foods; David M. Brawner, Sealtest Foods; Paul Hammond, Delvale Dairies, Inc.; and Earl T. Holsapple, Jr., Welsh Farms, Inc. Mr. W. A. Wentworth, Frankfort, Kentucky, was elected Honorary Director.

The Board of Directors met following the business meeting and elected the following as officers: *President*, A. J. Nixon, Penn Dairies, Inc.; *Vice-President*, A. J. Claxton, Beatrice Foods Co.; *Treasurer*, Robert North, International Association of Ice Cream Manufacturers. Dr. A. C. Dahlberg and Harold J. Barnum will continue as Advisor to the Board and as Executive Secretary, respectively.

It was reported by Harold J. Barnum that the major efforts of DPII during the past year were directed toward the implementation of the National Labeling Committee.

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## California Health Officer Views Program Evaluation<sup>1</sup>

Criteria for evaluating proposed public health programs were discussed by Dr. Dwight M. Bissell, health officer of San Jose, California, at the first seminar for part-time health officers in the state which was held last summer. Questions against which he suggested that program plans be measured were:

Are they consistent with immediate and anticipated human needs?

Are they soundly grounded in agency philosophy and consistent with the philosophy of the health professions?

Are they based on accurate, imaginative statistical and community research?

Are they feasible and flexible enough to allow for the unexpected?

Are they consistent with available or providable funds and personnel?

Are they acceptable to the community?

Are the plans simple enough that they can be interpreted to the staff and to the public?

Are they progressive? Are they designed to improve, strengthen, or focus the service in such a way that each point in the planning leads to improvement of performance or shapes relationships to the needs?

Dr. Bissell enumerated the following as steps to be followed in planning:

Establish community need through statistical analyses which are available, through surveys, through

<sup>1</sup>Reprinted from February, 1963, *Health Officers News Digest*.

discussions with community groups, or by other reliable procedures.

Set the objectives, defining the desired outcomes.

Select the action of choice from possible alternatives.

Establish priorities in doing the job.

Allocate or delegate authority and responsibility for units of the program.

Determine which phase of the program should be conducted at a specific time and at what time the next phase of the program should be started.

Estimate the personnel and budget requirements.

Establish controls and measurement or evaluation procedures.

In his closing remarks, Dr. Bissell stated: "Public health is not measured in weeks or months, but in years, and sometimes in decades. Public Health, being a social science rather than a more exact science, is dealing with problems of change of human behavior . . . It requires vision, imagination, and the ability to accept disappointment and criticism. It demands that you be a philosopher, a scientist, and a counselor, but above all, that you possess a tremendous desire to be of assistance to your fellow-man."

## Carmony Assigned New Position



Lyle P. Carmony has been appointed manager of the Milling and Baking Products Division of Sterwin Chemicals, according to a recent announcement by President Robert S. Whiteside.

In his new position, Carmony will be responsible for sales and promotion of Sterwin's complete line of products for the baking and milling industries. He joined the firm in 1947 in a sales capacity in the St. Louis area and later became district manager of that area. Carmony earned his bachelors degree in milling administration and chemistry from Kansas State University.

His new position will locate him at the company's main office in New York City.

## Classified Ad

FOR SALE

Single service milk sample tubes. For further information and a catalogue please write, Dairy Technology, Inc., P. O. Box 101, Eugene, Oregon.

## SPECIAL FEATURE

# Tax Free . . . . . ?

Yes, benefits paid to members of our association through our new GROUP INCOME REPLACEMENT PLANS are tax free. This is just one added reason for you to submit your application, now, during our CHARTER ENROLLMENT PERIOD, to secure this vitally important insurance coverage protecting you against loss of income when totally disabled because of accidents or illnesses. Further, benefits are paid in full regardless of what other insurance coverage you might have on either a personal or group basis and in addition to what other compensation you might be entitled to, if any, from your employer.

Is this protection really important? Well, more than likely we all have adequate insurance protection on our homes, our furniture, our cars, but one thing only makes ownership of this property possible — INCOME. We feel that the need is as basic a need as three meals a day, because it takes income to BUY those meals, as well as to alleviate the financial stress and strain which inevitably accompany an illness or accident.

Certainly, none of us looks forward to trouble, but if it comes, your participation in the Group Income Replacement Plans will help put the proverbial silver lining around those clouds.

If you haven't submitted your application as yet, please do it today. Your participation will help you; it will help your fellow members who might be unable to secure this coverage through any other source because of past medical history and it will help us to obtain this coverage for you as an added membership benefit at *low* group rates.

So, send your application in today. We all thank you.

## REGISTRATION BILL PASSES

The Committee on Education and Professional Development of the Indiana Association of Sanitarians announced early this month the passage of the Sanitarians Registration Bill for that state.

On March 7, 1963, the Indiana Senate passed the measure by a 33 to 10 margin. The success came after several upsets and disappointments. "It is a tremendous tribute to the stalwart and persistent effort of our membership that the Bill met with success," praised the committee.

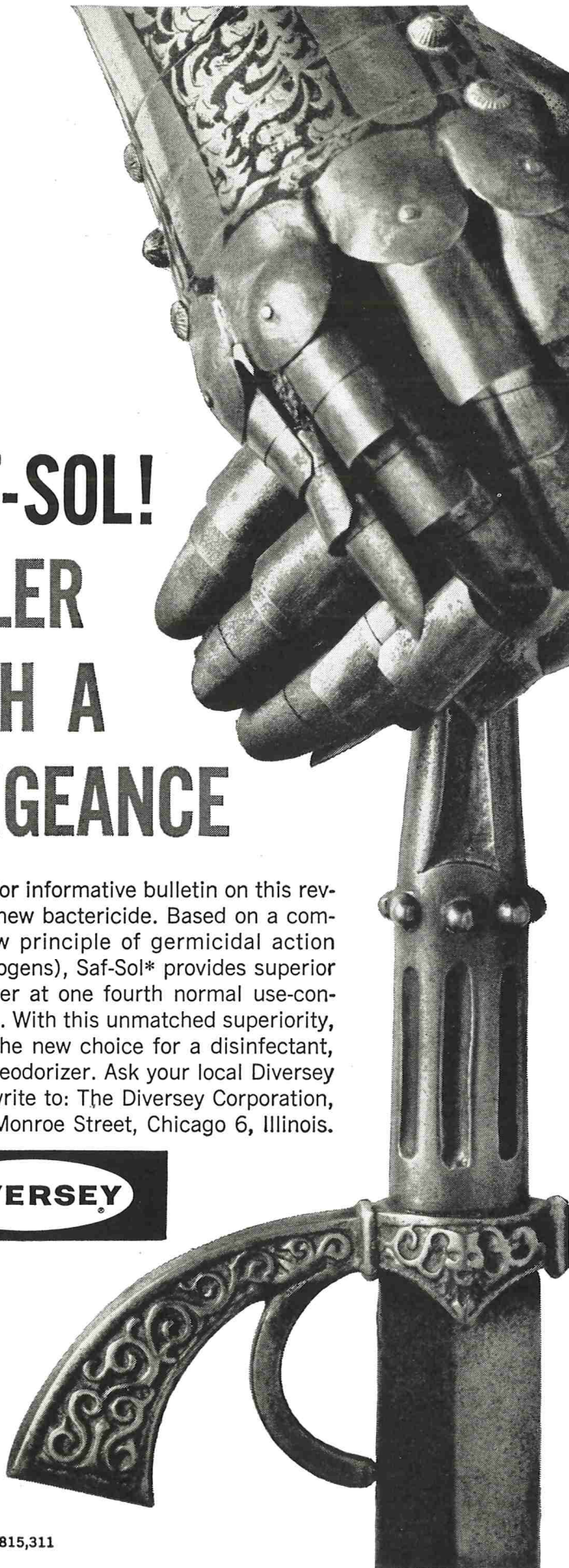
More details about the legislation will be given at a later date.

# SAF-SOL! KILLER WITH A VENGEANCE

Send now for informative bulletin on this revolutionary new bactericide. Based on a completely new principle of germicidal action (mixed halogens), Saf-Sol\* provides superior killing power at one fourth normal use-concentrations. With this unmatched superiority, Saf-Sol is the new choice for a disinfectant, sanitizer, deodorizer. Ask your local Diversey D-Man or write to: The Diversey Corporation, 212 West Monroe Street, Chicago 6, Illinois.

**DIVERSEY**

\*U.S. Pat. No. 2,815,311



## EVENTS IN APRIL

- April 2-3 University of Nebraska, Dairy Industry Conference, Nebraska Center for Continuing Education, University of Nebraska, Lincoln, Neb. Write: T. A. Evans, 101 Dairy Industry Bldg., Lincoln 3, Nebraska.
- April 9-10 Third National Food Engineering Conference, Michigan State University, East Lansing, Mich. Write: Continuing Education Service, Michigan State University, East Lansing, Michigan, Attention: Mr. A. L. Rippen, Food Science Department.
- April 9-10 University of California, 6th Milk Concentrates Conference, University of California, Davis, Write: Professor W. L. Dunkley, Dept. of Food Science, University of California, Davis, California.
- April 15-18 Ninth National Conference on Interstate Milk Shipments, Peabody Hotel, Memphis, Tenn. Write: Karl Mohr, Green Bay Health Department, Green Bay, Wisconsin.
- April 16-17 Iowa Milk and Ice Cream Manufacturers Association, Annual Convention, Roosevelt Hotel, Cedar Rapids, Iowa. Write: John H. Brockway, 710 Fifth Avenue, Des Moines 9, Iowa.
- April 17-19 Institute of Environmental Sciences Annual Technical Meeting and Equipment Exposition, Statler Hilton Hotel, Los Angeles, Calif. Write: National Office, IES, 34 S. Main St., Mt. Prospect, Illinois.
- April 21-23 Indiana Dairy Products Association, Annual Convention, French Lick-Sheraton Hotel, French Lick, Ind. Write: Ward K. Holm, 6C3 Union Title Bldg., Indianapolis, Indiana.
- April 29-May 2 Twenty First Annual Meeting, United States-Mexico Border Public Health Association, Nogales, Ariz. Write: Ulpiano Blanco, Secretary, 501 U. S. Court House, El Paso 1, Texas.

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## Slate Of EMA Officers Released, Gordon Ellis Elected President

Gordon Ellis, Executive Vice President-Operations, Pet Milk Company, St. Louis, was elected president of the Evaporated Milk Association at a Board of Directors Meeting February 7. The election followed the Association's annual meeting held in Chicago, according to an announcement by Fred J. Greiner, Executive Secretary.

Other officers are: L. G. Butler, the Borden Company, New York, vice-president, and G. J. Hoffman, Dean Milk Company, Chicago, treasurer. Members of the Board elected at the annual meeting include: J. D. Anderson, The United Dairy Company, Barnesville, Ohio; R. R. Brubaker, Carnation Company, Los Angeles; E. R. Gehl, Gehl's Guernsey Farms, Inc., Milwaukee; W. N. Harsha, Pet Milk Company, St. Louis; and G. B. Page, The Page Milk Company, Merrill, Wisconsin.

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